RAILROAD GAZETTE

FRIDAY, MARCH 6, 1903.

CONTENTS

When this issue of the Railroad Gazette is in the hands of its readers, its office will have been removed to 83 FULTON STREET, at the corner of Gold street, east of Broadway.

Contributions

Automatic Stops on the Boston Elevated.

Boston Elevated Railway Co.,
Boston, Mass., Feb. 16, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read your editorial on the Westfield collision in the issue of Feb. 6, but I cannot agree with many of its statements and conclusions. We have been using the automatic stops on our road since June 10, 1901, and consequently have had a great deal of experience with them. As you know, this device consists of a tripper operating in connection with the signal, which tripper when the signal is at danger rises alongside of and above the level of the running rail. On the car truck is an extension of the train pipe with a cock at its end, the handle of which projects down in such a manner as to strike the tripper when it is up, thus turning the cock, opening the train pipe and setting the brakes. In our case, as each car of a train is supplied with this automatic stop device, we have to use an overlap or the first wheels of the train would set the signal as they go by it, thus setting the tripper and tripping the cocks on the rear cars of the same train. We use an overlap of four car lengths, or 200 ft., and at some high speed points a longer one.

Referring to the editorial in question, page 100, third column, second paragraph, you say "all machines thus far devised are liable to omit to give notice of the failure of some of their parts; and as their failure to act is equivalent to a go-ahead signal a false indication may be given. With automatic stops it is much harder to enforce human vigilance, for the runners will naturally depend on the machine." This [last] statement is unfounded, as the automatic stop device has nothing whatever to do with the signal. The runner cannot depend upon the automatic device instead of on the visual signal, as the action of the device would be to stop his train with the "emergency" which would be known by every trainman and every passenger, and would necessitate his getting off of the train to reset the cocks on the different cars, and would mean certain knowledge of the event by his superintendent. Of course, in freight service, especially local freights, where the train crew are thoroughly acquainted with one another, there would be danger of the event not being reported if it happened at some remote point; but in passenger service where the discipline of the train crews is better and where they are not on intimate terms one with another, the case would be sure to be reported.

The failures of the automatic stop will be so few that it is no more likely for it to fail than for the signal itself to fail; so that if we take the law of chances we shall find that many millions of signal operations must take place to each possible combination of failure on the part of the runner to observe the signal in combination with a train in the block ahead in such a position as to cause accident, and failure of the automatic device to stop the train.

Our experience with these automatic stops has been that not only will they help prevent accidents on account of the failure of the runner to observe signals, but that they practically prevent the runner from failing to observe signals; that is, the moral or the disciplinary effect is such that the men do not run past signals.

We are running an average of 702 round trips of 10 miles per day, or 256,349 round trips a year. On each round trip the runner passes 68 signals which have automatic stops, and it is safe to say that on the average he will find not less than two signals against him on each round trip. This is owing to the frequency of the blocks and of switches and the very close headway; and yet our record for running past signals shows that we have had but 11 cases during the year 1902. In five of these cases the runner overran the signal but a few feet, less than a car length, which was proved by the fact that only the cocks on the front car were turned.*

On page 101, bottom paragraph, reference is made to permissive blocking. Our rule is that on coming to a signal at danger and the signal not clearing in three minutes, the train shall proceed with extreme caution to the next signal. This requires one of the trainmen to get down from the train, pull the signal arm to a clear position and hold it there while the whole train goes by. We have found no trouble whatever in working under this rule and do not find that any serious delays have resulted.

I agree entirely with the position the *Railroad Gazette* has always taken, that perfect discipline is the best safeguard; but the point I make is that the automatic stop is the best possible disciplinarian.

In answer to the question on page 102, last paragraph: "Are we to admit that we can maintain such discipline there (Harlem River draw bridge) but that it is impossible with block signals on a prairie?" I would say that it is not impossible to get such discipline if the automatic stop is used.

As to the necessity for having an automatic stop, I think it is fully answered in the second paragraph, page 101, where there is given a list of a few serious rear end collisions caused by failure to observe signals.

PAUL WINSOR.

An Expert's Experience With Automatic Stops.

Chicago, Milwaukee & St. Paul Ry.,
West Milwaukee, Wis., Feb. 27, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Having read with considerable interest the editorial on the subject of the Westfield collision appearing in your issue of Feb. 6, I would like to further extend the "point" you make regarding the use of the automatic stop; and while my remarks may be considered somewhat technical and as going too much into details to interest some of your readers, the subject is of such importance to railroad operating officials that a full and free discussion will be of benefit to the profession generally. In the non-use of the automatic stop, more so than with other appliances, it can be said that "the reluctance of enterprising railroad officials to adopt new inventions" is due more to a thorough comprehension of what these inventions will do and of the many objections to their use, than to ignorance on their part of the merits such appliances are supposed to possess.

On first consideration, the automatic stop would appear to be a very desirable addition to any automatic signal system; and one might be led to say, as does Mr. Kinsman in his letter published in your issue of February 13, "that when used in conjunction with visual block signals, the element of human fallibility of the engineer is provided for." As a matter of fact the automatic stop will guard against a collision only in certain cases, and in this case at Westfield the speed of the train would have been reduced only to 15 miles an hour had the brakes been applied at the home signal where the automatic stop would have been placed. The diagram published on your page 96 shows that the Easton train had stopped 1,200 ft. beyond the home signal, so that had the brakes been applied at this point the collision would not have been prevented unless the train, which was running at 65 miles an hour, had been fitted with the high speed brake. Writing on the question of the distance the distant signal should be placed away from a home signal in order to enable a train to be stopped in the distance between the two signals, Mr. E. M. Herr, General Manager of the Westinghouse Air-Brake Company, says:

" . . . In view of the increased speed of trains, I believe it should not be less than 3,000 ft. Trains running 80 miles an hour, even when equipped with the high speed brake, with a train-pipe pressure of 110 lbs., require from 2,300 to 2,800 ft. to make a stop with the emergency application, the distance depending largely on the number of cars in the train. The shorter distance is for trains of from eight to ten cars, the longer for trains of from four to six cars. As this speed is quite usual in many places, it seems clear that a distant signal should provide for this distance. With the quick action brake under ordinary train-pipe pressure, it requires from 3,000 to 3,600 ft. to make a stop when the train is running 80 miles an hour. In regard to the distance a loaded freight train would run, from tests made about a year ago, we obtained the following information.

"Fifty-car train, speed 34.9 miles an hour, service application, stop 2,604 ft.; speed 35 miles an hour, emergency application, stop 1,160 ft. Passenger trains running 60 miles an hour, with emergency application, ordinary train-pipe pressure of 70 lbs. per sq. in., stop 1,511 ft.; with high speed brake, 110 lbs. train-pipe pressure, speed 60 miles an hour, emergency application, stop 1,063 ft. The service application in the latter case makes the stop in about 1,900 ft."

Taking Mr. Herr's figures as correct, a train to be protected by an automatic stop should have room to go beyond the stop at least 3,000 ft., for while there may be but few trains that run as fast as 80 miles an hour, the occasion for this speed may arise at any time and the faster the speed the greater the necessity for avoiding a collision. With 3,000 ft. clearance required at each home signal, the signal circuits must be so arranged that until a train has passed this 3,000 ft. beyond a home signal there shall be two home signals in the stop position behind the train. This means that there must be an overlap section of 3,000 ft. used, whether a distant signal is used or not. As the usual practice on all roads in this country, with but one exception, is not to provide an overlap for an automatic home signal where a distant signal is provided, the practice of the whole country will have to be changed if the stop is to be used. If used with the present arrangement of circuits, a train stopped 25 ft. beyond a home signal will allow the second signal in the rear to clear, giving a following train the right to run up to but not beyond the home signal, which is only 25 ft. in the rear of the first train. If the engineer of the second train runs past the home signal the air is applied by the safety stop but the collision is not prevented. With 3,000 ft. overlap section in use the length of all blocks and the spacing of trains is practically increased by the length of the overlap; and when to this is added the distance of 4,000 ft., which is a safe distance for a distant signal to be placed from the home, the number of signals in use must be greatly increased if it is desired to run trains as closely as is now being done on many roads. Those in favor of the automatic stop will say, no doubt, that the need of an overlap is a mere detail of construction; but it is one which will increase considerably the number of signals in use, or else will require that trains be spaced 3,000 ft. further apart than is now being done.

As at present used, the automatic signal, as you point out in your editorial, is merely a permissive signal, and an engineer after having made a stop at a stop signal, is allowed to proceed under instructions to run with caution until a signal is found which is in the clear position. The use of the automatic stop will not change the character of this blocking; and unless a rule is made requiring the signals to be observed absolutely, collisions due to too fast running may still be looked for, as there are many instances on record where serious collisions have occurred from engineers running without due caution after the stop had been made at the home signal. It is immaterial whether the train be stopped by the safety stop, or by the engineer, if, after the stop has been made, the engineer runs into a train standing in the block. It is true that the supposed collision will not occur at so high speed as in this case at Westfield, but where the blocks are two miles or more in length, and there are many blocks of this length, there may be track room enough for a train or engine to attain a high rate of speed before arriving at the next signal.

In addition to the necessarily greater expense due to increasing the number of signals, there are inherent difficulties in the working of the automatic stop that make its use very objectionable; and this is the factor that will do more than anything else to keep the stop from being generally adopted. These objections are based on the necessity of blocking trains on the absolute plan, unless delays are to be permitted which will materially reduce the number of trains it would otherwise be possible to run over a given track.

If absolute blocking is not enforced, a train finding a home signal in the stop position, must be allowed to proceed after a certain length of time (usually one minute on double track and five minutes on single track). If this is done, as soon as the engine passes the automatic stop an emergency application of the brakes is made. It is immaterial whether the signal is at stop for a train in the block or for a failure of the circuits, the brakes are applied at the stop although the train may have waited at the signal the time required by the rules.

With a short train this emergency application may cause but a minute or two delay, but with a 50-car freight train, with all the air exhausted out of the train pipe and reservoir and these to be recharged, from 10 to 15 minutes will be required; and the road is blocked for this length of time. In some places this lost time may not be objectionable, but on crowded lines, and these are the places where an automatic stop is supposed to be the most needed, such long delays cannot be permitted. With blocks a mile and a half long there will be, on almost any crowded track, many trains stopped each day by a train being in the block ahead, at each of which stops the brakes would be applied by the automatic stop when the home signal was passed.

In addition to these there would probably be at least one stop due to a failure of the apparatus out of each 12 to 15 thousand signal movements, this proportion of signal movements to failures being the averages reported by several roads having more than 200 miles of double track equipped with automatic signals. On the Southern Pacific, as reported in the *Railroad Gazette* of January 2, there was one failure to every 184 (average)

*Trains tripped by automatic stops on signals, year 1902. Motorman unconscious, 1; signal light out, 1; expected signal to clear, stopped within a few feet, 4; did not see signal at danger, 3; total, 9.

train movements. Another road reports one failure to every 284 train movements. While the delays due to failures of well-maintained apparatus might not be burdensome (provided the failures occurred at places where trains would not be delayed thereby), it must be borne in mind that the failure may occur to a freight running on short time ahead of a passenger train.

With each of the two automatic stops that have been tried on surface railroads, no safe method of cutting out the automatic stop has been found that would prevent an application of the brakes when it was desired that the application should not be made, while at the same time insuring that the full application would be made when the signal was run by improperly, and it is unlikely that such an end will ever be secured. If the tripping apparatus is placed on the ground and opens an air-valve placed on one of the trucks, the valve cannot be closed until the train has been brought to a stop, and so all the air will have been let out of the train pipe. If the engineer is allowed to shut the valve before passing the signal and thus keep the air from being applied, there is nothing to make him stop again on the far side of the signal and cut the valve in.

If an engineer is to be permitted to put the automatic stop out of action thus easily, and has to be depended on to open the valve again to have the automatic stop work, he might just as reasonably be depended on to stop the train before running past the signal, and thus save the first cost of the automatic stop.

Our experience with air-brakes, in which it is necessary to rigidly enforce the rules about trying the brakes each time that a car or engine has been coupled to a train, shows that it would not be safe to allow an engineer ever to cut the valve out while on the road; and yet if the valve should be disabled and would not work, he would be obliged to cut it out.

If the valve is placed in the cab, or in any place convenient to the engineer's hand, there is the constant temptation to save time. This was shown with one of the systems tried, where the engineers invariably reclosed the valve before the brakes had been fully applied; and by so doing, in one or two cases, they came near running into a train stopped in the block ahead. Engineers are but mortal, and when an apparatus fails a number of times they naturally assume that the signal was at stop through a failure of the apparatus and will reclose the valve, going ahead at speed, when, as a matter of fact, the signal may have been at stop on account of a train in the block. With the valve on the engine and the engineer able to close it at any time, the action of the automatic stop is entirely within the engineer's control; the train will not be stopped unless the engineer desires it stopped. There is nothing to prevent the engineer from putting a piece of waste around the valve handle to keep it from turning, and there is no way whatsoever for anyone to detect such action in case it is done.

In the arrangement of the parts of the safety stop it is practically impossible to so construct the apparatus that a failure of any one of these parts will result in the brakes being applied. In the nature of things, with the tripping device on the ground and the valve on the engine, if the tripper becomes fastened down by sleet, or is carried away by a snow-plow, or by something dragging from a train, the air is not applied. If the control magnet and valve are placed on the engine, the current from the track must be carried into the engine to work the magnet and no practical method has as yet been devised by which this may be done.

If a third rail is not used, some of the circuits must be arranged on the normally open plan; and with this a failure will result in leaving the apparatus in the position indicating all-clear, and no application of air-brakes would be made. Such an arrangement is not safe; all successful automatic systems are arranged so that the signal will indicate stop whenever a failure of the apparatus occurs. If a third rail is used, the circuits may be arranged on the normally closed plan, but it is so difficult to pick up a signaling current from this third rail that the arrangement cannot be considered practical or suitable for use on surface roads. With the normally closed circuit any interruption or breaking of the circuit causes the stop to act. With any circuit through a third rail it is practically impossible to make the circuit continuous; and at every break in the rails, at crossing frogs, groups of switches, slip switches and the like, the brakes would be applied whether there was a signal at such a place or not. In the case of ice forming on the third rail, the wheel rolling on this rail would sometimes be raised and not make a contact. This happens occasionally with the wheels of a small engine or light car so that unless as much weight were put on the wheel running on the third rail as is done with the other wheels of an engine, a continuous contact would not be made.

If it were possible to put a high voltage circuit on the third rail, some arrangement might be devised for picking up the current successfully, but as motor cars of trains on the elevated roads are sometimes stalled on account of sleet and ice forming on the third rail and preventing contact, although a 550 volt circuit is used, it is evident that where the rail carries a current of but 0.9 of one volt, a small amount of ice, snow, dirt, or other substance may break the contact and apply the brakes.

Our experience with track circuits as now used has clearly shown the impossibility of maintaining the circuit when a higher voltage than that given by one gravity cell is employed. A track circuit having 15 ohms resistance between the two rails is considered well insulated, but the resistance in wet weather is more often 3 or 4 ohms than it is 15. As the resistance often falls as low as one ohm, or even half an ohm where the track is laid through yards and the ballast is in contact with the rails, it is evident that a current of the same voltage as is now used in the track circuit must be employed for the third rail; and where such low voltage is used it will practically be impossible to carry this current to the engine without troublesome interruptions.

The automatic stop is not adapted for use at places where there is any switching to be done, for while an engine may pass a signal if it is in the clear position, the stop will act and apply the brakes in case the engine is backed up past the signal. Where more than one engine is used for a train, all engines back of the first one must have the stop valve cut out or the brakes will be applied, for the signal is set by the first engine and would be in the stop position by the time the second engine reached it. So also, on double track, when a train is run opposite to the usual direction the valve must be cut out or the brakes will be applied at each signal passed.

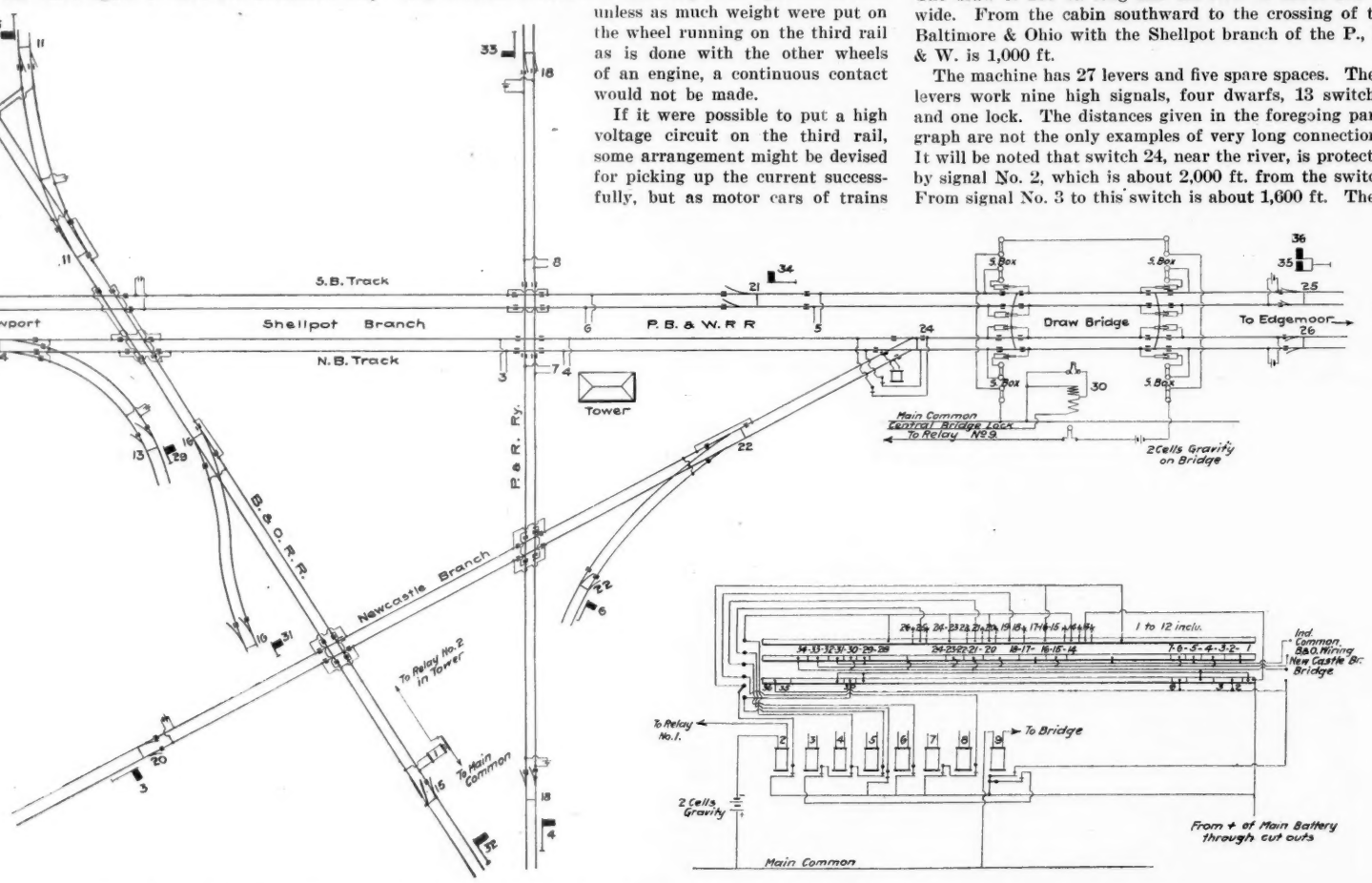
No doubt other situations exist where the automatic stop will be found unworkable, but with those that have been here spoken of, and with the many defects to be found in the construction of the apparatus, there is more than enough to convince a signal engineer, or a practical operating official, that the automatic stop should not be depended upon to materially reduce the number of collisions or to safely guard against the element of human fallibility on the part of the enginemen.

W. H. ELLIOTT, *Signal Engineer.*

Electric Interlocking at Wilmington.

The Taylor Signal Company, of Buffalo, has taken a contract for putting in an "all-electric" interlocking plant on the Philadelphia, Baltimore & Washington at Christiana avenue, Wilmington, Del., and the arrangement of the tracks is shown on the diagram given herewith, which, however, is not drawn to scale. The double-track line is the Shellpot branch of the Philadelphia, Baltimore & Washington, and the single-track line diverging from the double line at switch 24 is the Newcastle branch of the same road. The line crossing at right angles, near the cabin, is the Wilmington Division of the Philadelphia & Reading and the line crossing to the left (south) of this is the Baltimore & Ohio. It will be observed that there are four crossings, a junction and a drawbridge, as well as two signals beyond the drawbridge. The scale drawing of these tracks shows that the distance from the cabin to the center of the drawbridge is about 1,100 ft., and to signals 35 and 36, beyond the drawbridge, about 1,900 ft. The draw is 250 ft. long and the river is about 800 ft. wide. From the cabin southward to the crossing of the Baltimore & Ohio with the Shellpot branch of the P., B. & W. is 1,000 ft.

The machine has 27 levers and five spare spaces. These levers work nine high signals, four dwarfs, 13 switches and one lock. The distances given in the foregoing paragraph are not the only examples of very long connections. It will be noted that switch 24, near the river, is protected by signal No. 2, which is about 2,000 ft. from the switch. From signal No. 3 to this switch is about 1,600 ft. These signals each protect two crossings. Signal 32 performs a similar function and also signal 34. Signals 2 and 3 not only cover the crossings, as shown, together with switch 24, but also the drawbridge, being suitably interlocked with the locks of the bridge.



Switches and Signals at Christiana Avenue, Wilmington, Delaware—Electric Interlocking, by the Taylor Signal Company.

The very complete arrangement of electric track circuits shown on this drawing is provided for the purpose of controlling the electric motors which work the switches and signals, in such a way as to afford the most thorough protection against false movements. Besides the ordinary electric locking there are electro-magnets, which absolutely cut off the electric power from the switch motor or signal motor whenever the signalman, by inadvertence or otherwise, attempts to give clear signals over conflicting routes.

Besides this complete electric locking the usual mechanical detector bars are employed, one or more bars being provided for each switch or derailing switch. The motors working the switches and derails are provided with a safety electric switch to provide against derangement if the signalman attempts to move the rails of a switch while they are covered by a train or engine. By means of an electro-magnet device, recently patented, any excessive increase in the resistance offered by the detector bar, as, for example, the resistance of a pair of wheels when an attempt is made to lift the bar while they are over it, will at once cause the withdrawal of the power circuit and thus thwart the action of the lever in the cabin.

The 32 functions in this machine are provided for in a frame only 6 ft. 8 in. long. The electric power for moving the switches and signals is derived from a 40-ampere-hour storage battery, and this, in turn, is charged by a 1 kw. Taylor generator run by a Fairbanks-Morse gasoline engine of 1½ h.p. This engine in eight hours will charge the battery sufficiently to make 10,000 switch and signal movements, and this amount of power is generated by the use of three gallons of gasoline.

The wiring of the machine is shown in the lower part of the drawing, at the right.

The Signaling Department of the Lackawanna.

The Delaware, Lackawanna & Western has lately issued a book of Rules of the Signaling Department; a pocket manual of 62 pages, bound in stiff paper. The instructions appear to have been prepared with much skill and care, and they are arranged after the fashion of the manuals of the American Railway Association. The first part is headed "Organization," giving the details and functions of each class of employees, from the signal engineer down to the batteryman; next come general rules, and then in their order, the rules for interlocking construction foremen; electric construction foremen; inspectors; interlocking repairmen; maintainers; fitters, interlockers, blacksmiths and helpers; batterymen, and lampmen. Following the rules are specifications for installation of automatic and electric signals and for installation of interlocking; and the last 15 pages are filled with questions for examining repairmen, maintainers and batterymen on their duties.

This book was prepared by Signal Engineer A. H. Rudd a short time before he left the Lackawanna road. As the questions for examination are a novelty in books of this kind, and as Mr. Rudd's questions embody much useful information on the subject treated, we copy them in full below.

QUESTIONS FOR THE EXAMINATION.

REPAIRMEN.

1. State rules for reports, reporting and changing residence.
2. State rules for covering section.
3. State instructions covering accidents at interlockings.
4. State rules regarding repairs and adjustment of slots.
5. (*a*) What kind of failures should have first attention? (*b*) Second?
6. What would you do on finding signal indicating clear, when it should show danger?
7. What hand signals are permitted?
8. (*a*) Under what circumstances would you change locking? (*b*) Remove it? (*c*) How would you try a combination?
9. State rule for maintenance of foundations.
10. How would you inspect for loose locks?
11. Give rules for maintenance of facing point locks, detector bars, and switch mechanisms.
12. (*a*) How often should locks be tested? (*b*) How often should general inspection be made?
13. Give rules for inspection in detail.
14. (*a*) What is proper stroke for switch points? (*b*) Detector bars?
15. How would you adjust (*a*) a switch? (*b*) A lock? (*c*) A signal? (*d*) A detector bar? (*e*) A bolt lock?
16. How would you repair a loose lock?
17. (*a*) What do you do before disconnecting any parts? (*b*) After disconnecting?
18. State rule for losing motion in switch connections.
19. Who is responsible for condition of lamps?
20. How much should pins be allowed to wear before being renewed?
21. What causes interlocking in machine to stick?
22. (*a*) How would you adjust a cross-over with switch at each end? (*b*) With switch and lock movement at one end? (*c*) With switch and lock movement at each end?
23. (*a*) Should stroke of front and back wires be different at tail lever of machine? If so, why? (*b*) Should tension be different on these wires?
24. (*a*) What would you do if you had to take a lock rod away to be repaired? (*b*) Would you leave a plunger or detector bar disconnected? (*c*) Where is pipe liable to buckle when switch is run through?
25. How would you tighten loose bar studs, pipe joints, pipe rivets, and rocker-shaft arms?

QUESTIONS FOR MAINTAINERS.

NOTE.—All questions should be answered with full details.

1. What is your first duty on reaching headquarters in the morning, provided no signals are reported out of order?
2. (*a*) If signals are reported out, what kind of failures should have first attention? (*b*) Second attention? (*c*) Third attention. (*d*) Fourth attention? (*e*) Fifth attention.
3. How and when would you make train inspection of signals?
4. (*a*) What would you do on hearing of a train wreck? (*b*) What would you do on hearing of an accident at a road crossing where bell is located?
5. Would you give a hand signal if signal were out of order? If so, what kind and when?
6. What would you do in event of signal standing clear with train in block?
7. How often should inspection of all appliances pertaining to signals be made?
8. State in detail how you would inspect a signal and the different appliances.
9. (*a*) Give rule for night inspection of signal lights. (*b*) Give rule for night inspection of signals.
10. How would you proceed on finding polarity of permanent magnet reversed at a signal, when you had no other relay?
11. What is the rule for adjusting Hall banjo signals?
12. How overcome failures caused by cracked or broken battery jars?
13. What will cause weak track battery?
14. In case of mechanical trouble at an interlocking, what would you do?
15. (*a*) What constitutes a track battery inspection? (*b*) A signal battery inspection?
16. Would you take a jar out of service which was cracked so that solution was leaking not more than one drop an hour?
17. Should the salts that crystallize around connections on batteries be removed?
18. Where you have two or more gravity cells in a chute, when would you renew them?
19. (*a*) Who is responsible for condition of batteries? (*b*) Who is responsible for material used and ordered? (*c*) Where, how, and to whom should old material be shipped?
20. (*a*) What reports are you required to make? (*b*) On changing address whom do you notify?
21. Why and when would you turn up number plates to caution?
22. State in detail what constitutes an inspection at an interlocking station.
23. (*a*) Would you change wiring or style of relays at any signal? (*b*) At interlocking station? (*c*) If so, under what circumstances?
24. (*a*) Give rule for keeping frost off commutators. (*b*) Should slots and armature be wiped off when making inspections?
25. In case of signal out of service at interlocking, whom would you notify when repairs were made.

Clear Failures.

26. If in doubt as to signal going to danger properly, what precaution would you take?
27. What two troubles are most liable to cause motor signal to stand clear with train in block?
28. What two troubles are most liable to cause banjo signal to stand clear with train in block?
29. How can automatic signal slots be prevented from freezing closed, holding signal clear?
30. How can residual magnetism be overcome in slow releasing relay, slot coils, etc.?
31. What would cause a clear distant signal with train in block?
33. In overlap system, what would cause signal to clear before train passed overlap?
34. In home and distant system, what would clear distant arm before home arm on signal ahead cleared?
35. What would cause a distant signal at an interlocking station to clear with home signal at danger?
36. (*a*) What will cause indicator to show clear with train on circuit? (*b*) What will cause indicator to show danger when it should be clear?
37. How could a slotted home signal at an interlocking station stand clear with train on circuit?
38. (*a*) Can a distant signal in home and distant system stand clear when points of slow releasing relay controlling home are fused together? (*b*) If it could do so, would it necessarily?
39. How could a track relay stay closed with rail taken out of circuit?

Signal Mechanism and Relay Failures.

40. What is the first thing you would inspect if signal were out of order?
41. (*a*) What is meant by motor brushes being on neutral point? (*b*) What is the result?
42. (*a*) How are signal arms adjusted? (*b*) What causes arm castings to break on motor or slotted signals?
43. (*a*) How should carbon points of all relays be cleaned? (*b*) How locate and test for defective carbon points in relays?
44. (*a*) On slotted home signals at an interlocking station, how would you adjust properly when signal is operated by wire? (*b*) When signal is operated by pipe?
45. (*a*) How would you stop a pole changer from bridging across both springs? (*b*) How often should pole changers be cleaned?
46. (*a*) If brake does not stop motor properly, what is the result? (*b*) How would you adjust brake?
47. (*a*) What causes commutators to spark? (*b*) What causes brushes to stick to commutators?
48. (*a*) What causes a signal slot to slip if battery is in good condition? (*b*) How would you remedy trouble if slot fingers failed to latch?
49. What troubles are caused by iron rust and scales dropping down inside signal cases?
50. (*a*) Why is it necessary to use a slow-releasing relay, or slow-releasing slot in home and distant system? (*b*) What effect does dirty back contact in track relay at signal case have on slow-releasing slot?
51. (*a*) What is the resistance of standard track relays? (*b*) What is the resistance of slow-releasing relays?
52. Should track relay be shunted when making inspections?
53. Why do slow-releasing relays have two windings?
54. (*a*) How are air buffers packed? (*b*) How can they be adjusted?

Track Relays and Track Work.

55. (*a*) Which are the most important insulated block joints? (*b*) State in detail how you would test out an insulated block joint?
56. (*a*) State in detail how you would test an insulated switch rod without disconnecting it? (*b*) How far open should facing switch point be before signal sets to danger?
57. (*a*) Name the causes of track circuit failures? (*b*) How would you locate same?
58. (*a*) How would you test for short circuit in track? (*b*) How would you test for leakage in track?
59. (*a*) How would you connect battery to overcome trouble caused by cinders or wet roadbed? (*b*) How connect battery to overcome trouble causes by loose bond wires?
60. What loss, if any, should instrument show where general condition of track is good?

Signal Wiring, Circuits, Relay Wiring, Etc.

61. Make sketch of wireless circuit showing wiring of semaphore signal for home and distant system.
62. Make sketch of wireless circuit showing wiring of semaphore home signal with separate distant.
63. Make sketch of wireless circuit showing wiring of one-arm distant semaphore signal.
64. Explain wiring and principle of Hall hold-clear attachments.
65. Make sketch of wireless circuit showing semaphore home signal wiring in overlap system.
66. (*a*) Explain in detail the principle of a polarized relay. (*b*) What causes polar armature to close with right polarity, and remain open with reverse polarity?
67. (*a*) Why is a neutral polar relay so called? (*b*) What is a neutral polar pole changing relay?
68. If relay at cut section is defective, how could signals be kept working if you had no new relay to put in?
69. What will cause a drop in potential between battery and signal motor?
70. In making tests on line wires, where would you skin wire?
71. How would you prevent corrosion of magnet wire in signal case?
72. (*a*) What is a closed circuit? (*b*) What is an open circuit? (*c*) What is a short circuit? (*d*) Which is the positive pole of the battery?
73. (*a*) Are track batteries on open or closed circuit? (*b*) Explain four ways in which gravity batteries are connected to track circuit.
74. Explain how cells can be taken out and cleaned in each of the above four cases without putting signal to danger.
75. (*a*) What is the result as to voltage and output of connecting battery in series? (*b*) In multiple? (*c*) In series multiple?
76. (*a*) What is the result of broken jar in track battery connected in series? (*b*) In multiple? (*c*) In series multiple?
77. (*a*) Give voltage and amperes of four cells of gravity battery in good condition connected in series. (*b*) In multiple. (*c*) In series multiple.
78. (*a*) Name the most common causes of track battery failures. (*b*) Give causes of gravity batteries crystallizing. (*c*) Why should Edison or Waterbury batteries never be connected in series with gravity batteries?
79. How long will an SS cell with 300 ampere hours' capacity last on normally closed circuit connected in the usual way with 3½-ohm relay?
80. (*a*) What is meant by internal resistance of a battery? (*b*) By polarization? (*c*) By local action?
81. (*a*) Where two relays are operated on same track circuit, should cells be connected in series or multiple? (*b*) Why?
82. (*a*) What causes Edison battery to look cloudy or unsettled? (*b*) What causes some cells to work harder than others when in service on main battery?
83. (*a*) Why is oil placed on top of soda solution in Edison and Waterbury batteries? (*b*) Why are bushings placed on top of frame where solution comes in contact with them? (*c*) What causes zincs to be corroded at top of solution?
84. (*a*) What is liable to occur if top of solution is below the proper line in Edison or Waterbury batteries? (*b*) What is the proper height?
85. (*a*) What results from having zincs in RR or SS batteries too close to copper oxides? (*b*) Too far away?
86. Give some of the causes of a signal battery exhausting prematurely.
87. (*a*) Give amperes and volts in 16 SS cells connected in series. (*b*) Give amperes and volts in 16 RR cells connected in series.
88. (*a*) Does oil or soap affect gravity batteries. (*b*) If so, how?
89. (*a*) How many volts required to operate slow-releasing relays of 2,600-ohms' resistance? (*b*) How many volts required to work motor? (*c*) Give least possible voltage required to work slow-releasing relay, motor, and home and distant slots.
90. In what ways can a cracked jar be detected?
91. What is the effect of low temperature on Edison batteries?
92. (*a*) How would you inspect track batteries? (*b*) Describe the appearance of a good cell of track battery. (*c*) Of a poor one.
93. How can you determine the condition of Edison SS or RR batteries?
94. Should oxide plates be put in service when so broken that the frame alone holds them together?
95. (*a*) What causes battery jumper wires and binding posts to corrode? (*b*) How would you prevent this?
96. If after renewing track battery signal did not clear, what would you do?
97. (*a*) In renewing main signal battery, how many cells would you take out at a time? (*b*) How would you keep battery closed?
98. Give directions for setting up Edison battery.
99. How would you detect a hard zinc?
100. State Ohm's Law.

BATTERYMEN.

1. (*a*) Who is responsible for the condition of batteries? (*b*) For material used and ordered? (*c*) State in detail rule for shipping old material.
2. What would you do in event of signal showing clear, when it should indicate danger?
3. (*a*) When should a block signal indicate danger? (*b*) When should an interlocking signal indicate danger? (*c*) When should a distant signal indicate caution?
4. (*a*) What hand signaling is prohibited? (*b*) Why, and when would you turn number plate to caution?
5. Make sketch and describe four ways in which track battery is connected.
6. (*a*) What is result as to voltage and output in each of the above arrangements? (*b*) Of cracked jar in each of the above arrangements?
7. What precaution should be taken to prevent connecting track battery with wrong polarity?
8. What would be the result of connecting track battery with wrong polarity?
9. Would you change wiring of track battery? If so, under what circumstances?
10. (*a*) Describe in detail how cells can be removed for cleaning in each of the four arrangements of track batteries without putting signal to danger. (*b*) State rule for time of renewing track batteries. (*c*) State rule for time of cleaning zincs.
11. (*a*) State directions for renewing gravity batteries. (*b*) For setting up gravity batteries.
12. (*a*) Name most common cause of track battery failures. (*b*) How would you detect a hard zinc? (*c*) Why does gravity battery crystallize? (*d*) What is effect of using oil or soap in gravity batteries?
13. (*a*) How would you inspect track batteries? (*b*) Describe appearance of a good gravity cell. (*c*) Of a poor one?
14. If, after renewing track battery, signal failed to clear, what would you do?
15. (*a*) Are track batteries on open or closed circuit? (*b*) How should track battery be connected to overcome leakage caused by wet roadbed? (*c*) By loose-bond wires?
16. (*a*) How would you connect main battery in signal case? (*b*) How would you connect main battery at interlocking station?
17. Give directions for setting up Edison battery.
18. (*a*) In renewing main battery, how would you keep battery closed? (*b*) How many cells would you take out at a time?

19. (*a*) How would you inspect SS and RR batteries? (*b*) Describe appearance of a good cell. (*c*) Of a poor one.

20. (*a*) What is liable to occur if zincs in Edison battery are too close to copper oxides? (*b*) Too far away? (*c*) If solution is below proper line? (*d*) What is correct depth of solution?

21. (*a*) Why do zincs corrode at top of solution in Edison battery? (*b*) Why are bushings placed on top of frames? (*c*) Why is oil used?

22. (*a*) Why should Edison and gravity cells never be used in the same battery? (*b*) Should broken oxide plates be put in service?

23. (*a*) Why does an Edison battery sometimes exhaust prematurely? (*b*) Why do single cells in a battery do so?

24. (*a*) What causes battery jumper wires and binding posts to corrode? (*b*) How would you prevent this?

25. (*a*) What is a closed circuit? (*b*) What is an open circuit? (*c*) What is a short circuit? (*d*) What is internal resistance? (*e*) What is polarization? (*f*) What is local action?

26. (*a*) What is positive pole of a cell? (*b*) What results from zincs touching copper? (*c*) What results from loose connections?

27. (*a*) How can a cracked jar be detected? (*b*) Would you take one out, if only leaking one drop an hour? (*c*) How would you connect to overcome such trouble?

28. Would you use hard of soft water in setting up battery?

29. (*a*) How often should battery be inspected? (*b*) Renewed?

30. (*a*) What disposal should be made of battery refuse? (*b*) Of old solution? (*c*) What would you do with defective material?

Proposed Trans-Continental Railroad in Australia.

Consular Agent C. A. Murphy has sent to the State Department, under date of Dec. 15, 1902, a copy of the advertisement for tenders to build a railroad across central Australia to Port Darwin. Tenders will be received until May 2, 1904, at the office of the Railways Commissioner, Adelaide, to build and work a line on the land-grant system between Oodnadatta, South Australia, and Pine Creek, in the Northern Territory, in accordance with the provisions of the Trans-continental Railway Act, 1902.

Land to be granted not to exceed 75,000 acres for each mile of line, and to be selected in alternate blocks on either side of the railroad; length of railroad, not to exceed 1,200 miles; route, as per plan in the act, or such alternative route as may be agreed; gage, 3 ft. 6 in.; motive power, steam or other approved power; rails and fastenings, steel (rails to be not less than 60 lbs. to the yard); land to be granted in fee simple, with all gold, metals, and minerals thereon and thereunder.

The tenders must specify land grant required, and number of miles to be built annually from each of the termini, respectively, and a definite date must be given for the completion of the work.

The December *Bulletin of the American Geographical Society* gives a summary of the trans-continental projects for Australia, from which the following is an extract:

"No railroad lines have as yet been extended across the Continent of Australia, but, in view of the growing importance of West Australia, with its vast resources in gold, the necessity for such a connection has become apparent. Plans have been formulated for three trans-continental lines, with the likelihood that one or more of them will be built.

"Sir John Forest, the First Minister of Defence of the Commonwealth, is the author of the project to extend the Southern System of railroads across the south part of the Continent, connecting Sydney on the east, and Fremantle on the west coast. This would involve a line of 1,068 miles along the coast on the southern edge of the great Victoria Desert to Eucla, and thence northwest to the well-known gold mining center of Calgoorlie, which already has a railroad connecting it with Perth, the capital of West Australia, and the port of Fremantle.

"A railroad is in operation between Adelaide, Port Augusta and the town of Oodnadatta, South Australia, and also from Port Darwin, 145 miles long, to Pine Creek in the heart of the mining region. It is planned that Pine Creek and Oodnadatta shall be the terminal points of the north and south railroad across the heart of Australia. Adelaide, on the south coast, would thus be connected with Port Darwin by a continuous route 1,896 miles long.

"Plans have also been made for another north and south trans-continental route to the east of the route just mentioned. This line is projected to be built in a comparatively straight line between Bourke and Pine Creek, 1,600 miles. Its completion would link Sydney with Port Darwin by a continuous railroad 2,247 miles long. The first-named of these north and south railroads would be the shorter, but with the disadvantage of passing through the uninhabited and worthless desert of central Australia. The longer route between Sydney and Port Darwin would have the advantage of passing, in its southern portion, through a great region of grazing land.

"The trans-continental connections of Sydney and Adelaide with Port Darwin, are expected to have a great effect upon the fortunes of that port, and it is probable that in time it will become the terminal port in Australia of a steamship line plying to Port Arthur, China, thus greatly shortening the time between Australia and the ports of northwest Europe."

The Van Dyke Tank Car.

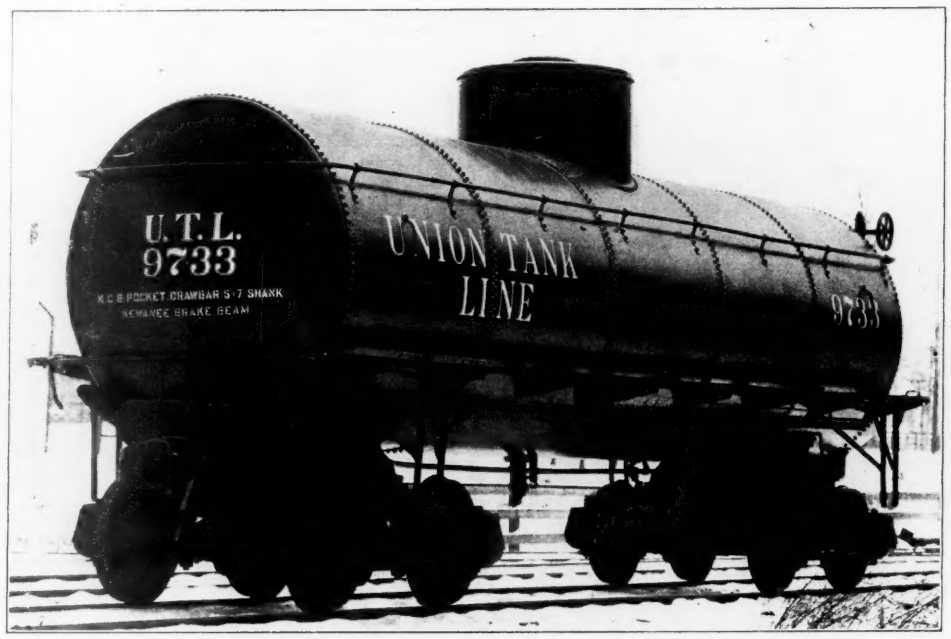
The Union Tank Line has recently placed in service a tank car which is a radical departure from previous designs. As shown by the accompanying engravings, the car is devoid of underframing, consisting essentially of a tank and trucks. The tank is not only self-supporting, but also transmits all draft and buffing stresses, and acts as a column, a beam and a tension member.

In order to provide in the structure the needed rigidity the bottom sheets have a thickness about double that of the top sheets. This thickened bottom section is made up of three $^{11}/_{16}$-in. sheets, the end ones being 9 ft. long and the center one 16 ft. 10 in. long. These sheets have double-riveted lap joints with ⅞ in. rivets. The upper sheets, five in number, are joined together and to the bottom sheets with ¾-in. rivets.

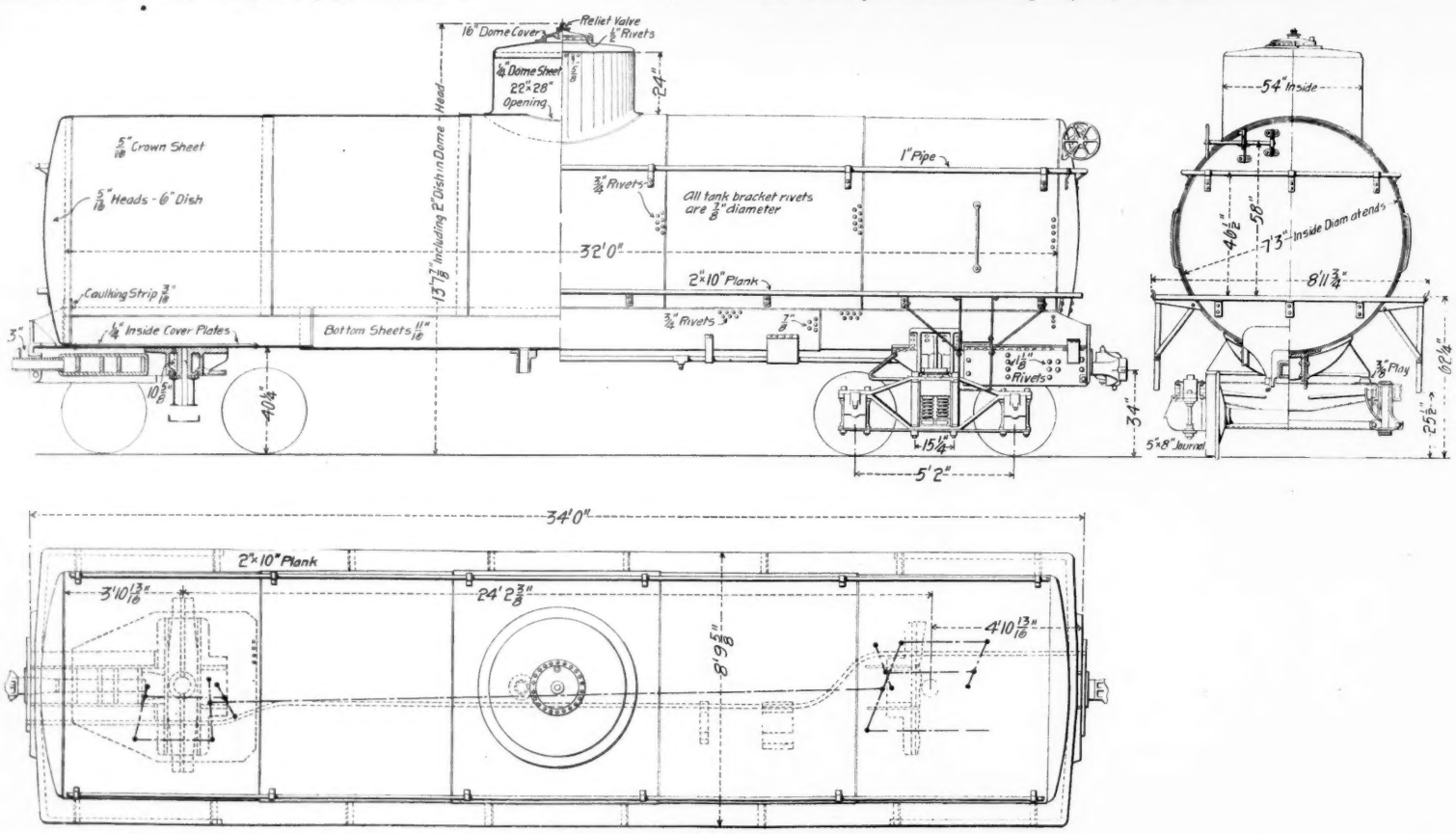
The bottom sheet at each end projects 11½ in. beyond the calking strip of the head seam. On this projection is riveted a malleable-iron nose piece, shown in detail in the engravings. This nose piece acts as a buffer block, protecting the head of the tank. It is formed with a rectangular opening which surrounds the drawbar shank on three sides. A 1¾-in bolt, having on it a 2-in. sleeve, supports the drawbar, and at the same time allows freedom of movement.

The tank rests at each end upon a combined saddle and body bolster casting. It is riveted to the tank with 1⅛-in. rivets.

Extending forward from the saddle to the end of the



The Van Dyke Tank Car—Capacity 10,000 Gallons.

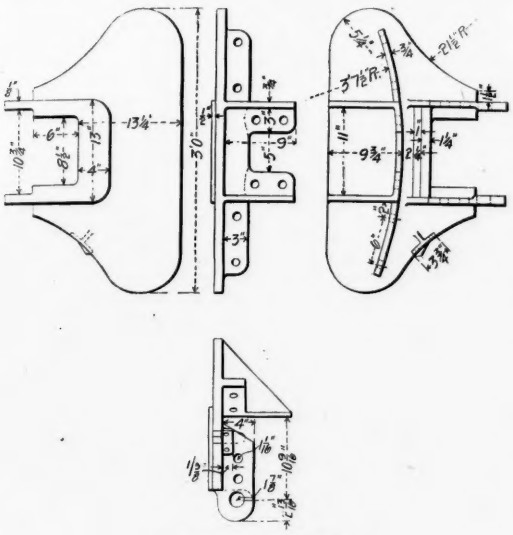


The Van Dyke 10,000 Gallon Capacity Tank Car.

tank and secured to the latter by 1⅛-in. rivets are two angle plates forming a housing for the draft-gear, which is a tandem twin-spring arrangement. Malleable follower stops are riveted inside these angle plates, for all except the rear follower, which is backed up by projecting stops cast on the saddle.

As the shearing stresses on the rivets which secure the angle plates and the saddle castings to the tank must necessarily be quite severe, provision against loosened rivets and consequent leaks is made by covering this part of the bottom sheet by a plate riveted on the inside of the tank. The joint is tightly calked and as the plate is not subjected to stresses which would affect the joint, tightness is insured.

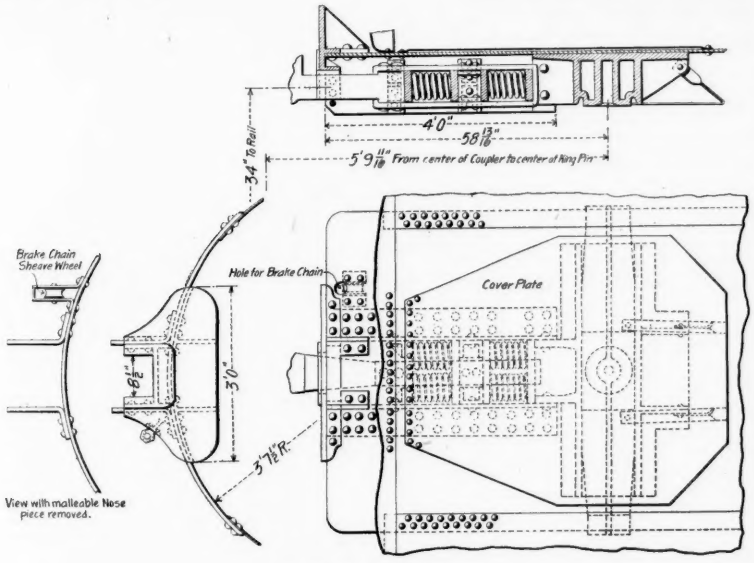
The design of the shell brackets also indicates the precautions which were taken against leaks. Extra heavy



Malleable Nose Piece.

(¾-in.) rivets are used, so that if overstrained the rivet holes in the bracket would break out without damaging the tank.

The trucks, which are all-metal, were made especially rigid, the arch bars being 1¼ in. thick and 5½ in. wide. The bolster is designed to carry 35 tons and the wheels weigh 650 lbs. each.



Draft Gear Details.

Other points are the placing of the brake rods, pipes and cylinders, the running boards, hand-rails and steps, the details for all of which have received careful attention.

The relief valve on these tanks is about nine times larger than the style that has been in general use throughout the Union Tank Line system. The valve is designed to provide an area sufficient to maintain a gage pressure not to exceed 35 lbs. in case the tank be subjected to heat of sufficient intensity to cause the formation of oil vapor. The calculations must include factors relating to the area of the tank figured as heating surface, and the flow of oil vapor through an orifice. It is estimated that the valve on a 10,000-gal. tank would permit the discharge of that entire amount of oil (80 deg. Beaumé) in about 2¼ hours, assuming the valve to be worked to its full capacity during the entire period.

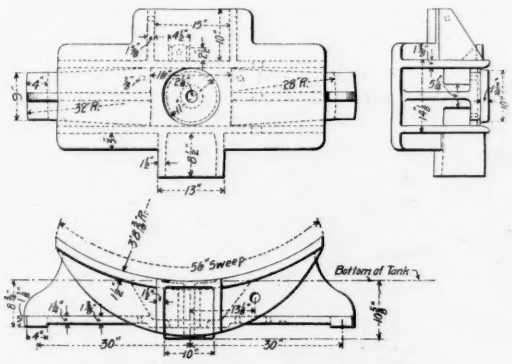
A sample car was subjected to buffing tests. Three tank cars, the foremost of which was a Van Dyke car, were coupled together and the brakes set on the rear two. Two other tank cars were coupled and driven against the stationary cars, first at 7.88 m.p.h. and then at 11.08 m.p.h. The Van Dyke was a 6,000-gal. car, actual capacity 6,078 gals.; the light weight was 24,260 lbs. The two cars backing it up had capacities of 8,107 and 6,543 gals. respectively; and the moving cars 6,156 and 7,887 gals., in the order given. All were loaded except the rear stationary car.

All cars were in good condition prior to the test. The only injury sustained by the Van Dyke car was a broken coupler shank and guard arm. Of the moving cars the foremost had a broken center sill (10 x 10 in.), broken journal box and coupler, broken or damaged blocking, and various bad leaks. The rear moving car and also the stationary car immediately back of the test car were similarly damaged, though not quite so badly. The rear stationary car sustained no injury.

There are at present 50-6,000 gal., 25-13,000 gal. and 90-10,000 gal. capacity cars of this kind in service, and 150-10,000 gal. cars are building. The designer is Mr. J. W. Van Dyke, formerly General Manager of the Solar Refining Co., Lima, Ohio, and since Feb. 1, General Manager of the Atlantic Refining Co., Philadelphia, Pa.

New York Railroad Club.

No regular paper was prepared for the February meeting of the New York Railroad Club, but the meeting took up and discussed a number of subjects which are now being investigated by committees of the Master Car Builders' and the Master Mechanics' Association. Mr. C. A.



Combination Saddle and Body Bolster.

Seley, Mechanical Engineer of the Chicago, Rock Island & Pacific, who is also chairman of the Master Mechanics' committee, opened the discussion on "Electrically Driven Shops." He thought that electric driving was the proper method, but believed that the conditions affecting each individual case should be carefully considered. He suggested that all tools under the cranes be individually driven, as should also isolated and very large machines. He thought, however, that all tools requiring less than 5 h.p. should be shaft driven.

Mr. Kern Dodge, of the firm of Dodge & Day, Philadelphia, prepared a paper on the same subject, an abstract of which follows: "One of the pioneer papers on this subject was read before the Manchester Association of Engineers, in 1895, by Mr. Daniel Adamson. Since that date many interesting additions to the literature on the subject have been made, but the greatest discovery, or invention, bearing upon the matter was that of the high-speed tool steels. Mr. Fred W. Taylor, in bringing before the mechanical world the Taylor-White steel, gave a remarkable impetus to the development of steel cutting tools. But the finest motor equipment and best tool steels are inefficient unless our machine tools are modified and re-designed so as to give greater rigidity between the motor and the tool.

"New drawings and patterns and a great deal of experimental work will be needed in order that theory and practice may harmonize. In the trade catalogues of the past a line of drill presses may be shown in which, with the exception of using back-gears after a certain size is reached, the drawing simply represents the smallest machine photographed up to satisfy the demands of illustration of the various other sizes, so that from the largest to the smallest the dimensions of the parts progress symmetrically throughout. In the future the 12 in. lathe may, and properly should have just as heavy gearing, the same power applied to it and the same rigidity as the 36 in. with the exception of a proper allowance for the leverage strains. The power to be transmitted to the work and resisted by the tool post will, in many cases, be the same in all sizes, and, as a consequence, the design of the tool of the future would look abnormal as compared with the designs of the past. There is no logical reason why a lathe of 36 in. swing and a lathe of 12 in. swing should not both be capable of removing the same amount of metal in a given time.

"It is possible that the machine tool of the future will not be rated by its swing—as in the case of lathes—but will be rated by the amount of metal removed. In other words, the rating may be by the depth of cut and feed at 60 ft. on 40 carbon steel in all diameters; and in the case of drill presses, the rate at which a given size drill will penetrate some standard material, as it is from the data of metal removed in all cases that the tool will have to be designed. The present ratings of bed and swing or gap, as the case may be, will simply indicate the general dimensions of the tool.

"The new tool steels and motor driving have clearly shown the weak spots of old designs and I recall, among other instances, a 48 in. lathe doing economically work that could be easily handled on a 24 in. lathe; but the 24 in. existing design will not pull the cuts and feeds which should be taken and are taken by the 48 in. lathe.

"For many years the tool was the weak spot. Tools would be burnt or quickly dulled or broken off without any damage being done to the machine itself. With the data now at hand, it is possible to make a complete analysis of the gearing and even the framing itself, and so modify and strengthen the tool as to make it transmit the energy which the motor delivers. The machine tool builders who are progressive enough to realize that the motor-driven tool and the high-speed tool steel have come to stay, will certainly reap a rich reward.

"I wish to lay special stress on the absolute necessity of having variable speed control on a vast majority of tools in the future. The old step-cone is doomed to extinction. In practice to-day it is possible and practicable to attach to machine tools a variable-speed motor having a range as high as 6, or even 7 to 1, with steps of about 5 per cent. in speed change. It is certain, however, that the increments in speed should never be greater than 15 per cent. In the step-cones now in use we find variations between adjoining steps of from 40 to 60 per cent. This was all right at a time when the paramount duty of the operator of a tool was to keep from dulling or breaking his tool; but now, when a premium is placed upon the proper rapid dulling of the tool, the properly controlled motor is the only driver to be seriously considered."

At the conclusion of Mr. Dodge's paper one member suggested that speed control was the important thing, and that if a mechanical drive could be designed to do the work satisfactorily, and if its cost of maintenance, etc., was low, he saw no reason why it should not be as good as the electric motor. Another member stated that in a shop which he had recently visited he was informed that 500 volt motors were connected to cone pulleys and that considerable trouble had been experienced on account of heating. On the other hand, he had equipped other shops with motors of 110 volts without any difficulty from this source.

Mr. R. H. Soule thought that the motor drive was a little overdone. He had in mind two shops recently built in which the entire floor space was covered with machine tools, thereby cutting off many of the facilities of the shop. The motor drive made such crowding possible. He was also of the opinion that hoists serving individual machines could be used in many cases to better advantage than the large electric traveling cranes serving all the tools in a shop.

Mr. George W. West, Superintendent of Motive Power of the New York, Ontario & Western, asked wherein was the economy in installing 100 h.p. of motors to drive a shop operating normally with but 25 h.p. In answer to this Mr. Dodge said that the primary advantage of the motor drive was not in the saving of power but in the possibility of obtaining variable speed and thus increasing the output. The reason why 100 h.p. of motors is required to drive a shop running normally with but 25 h.p is that provision must be made for running all the machines at maximum capacity at the same time. Mr. West still insisted that the installation of so many motors was an unnecessary investment and entailed considerable loss due to the interest and depreciation. Mr. Dodge replied to this by saying that he had data on two years' operation of a shop before and after the installation of electric drives and the result showed that a reduction of 29 per cent. in the cost of labor was credited to the motor drive, which figure leaves a considerable margin in its favor. He admitted, however, that in some cases where the work was always of the same character and where each machine was kept always on the same class of work that there was not much economy to be gained by the installation of electric driving. He had made an experiment with a large drill press in which the man operating the machine was required to shift the belt every time the character of the work indicated that such was necessary. At the end of the day the man was thoroughly tired out, indicating the impracticability of expecting the workman to operate a belt driven machine always at maximum efficiency.

Front Ends.—Mr. H. H. Vaughn, Assistant Superintendent of Motive Power of the Lake Shore & Michigan Southern, and chairman of a committee of the Master Mechanics' Association on "Locomotive Front-Ends," opened the discussion on this subject. He referred to tests lately made at Purdue University, which had established the proper relation between size of stack and exhaust nozzle for a front-end 54 in. in diameter; but the problem now before the committee is, What should be the proportionate increase in the size of stack for a certain increase in the size of the front-end? Other tests are to be made to determine the effect of projecting the stack into the front-end and also whether it is possible to omit the baffle plate.

Mr. William McIntosh, Superintendent Motive Power of the Central of New Jersey, stated that widening the base of the stack had given satisfactory results. He saw no advantage in extending the stack into the smoke-box, but thought that there might be some advantage in using

a double stack with an annular opening between the inner and outer sections.

Mr. A. M. Waitt, Superintendent of Motive Power of the New York Central, said that one of the companies with which he had been connected had used a standard stack for all sizes of front-ends and locomotives, and it had been found by experiment that the large stack on the small engines did better work than the same size stack on the larger engines, which indicated that the diameter of the stacks as usually used is too small. He also thought that a large stack would produce a freer steaming engine and that there would be less liability of throwing fire. The exhaust pipe should also be lowered.

"Piston Valves."—This subject was opened by a letter from Mr. F. F. Gaines, Master Mechanic of the Lehigh Valley and also chairman of a committee of the Master Mechanics' Association on this same subject. He did not favor the piston valve and could ascribe no reason for the apparent popularity of the type. The only advantage which he could see was in its small ports, and he was not certain that the claims on this point could be substantiated. Some gain might be obtained by reason of the shorter clearance of the piston valve but with the present designs of balanced slide valves the same clearance may be obtained. The piston valve is also very expensive to maintain. The packing ring continually causes trouble and the relief valves which are necessary are uncertain quantities after having been in use for some time.

Mr. McIntosh did not believe that piston valves cost any more to maintain than other types, and said that his experience with the piston valve had been entirely favorable. Many have been in service on his road for some two years without having to be rebored. He thought that much of the trouble with piston valves was due to the different kinds of packing used. A particular advantage in the piston valve is that no difficulty is experienced in keeping the steam chest tight, which is a common cause of trouble with slide valves.

Mr. G. W. Wildin, Mechanical Engineer of the Central of New Jersey, thought that the chief advantage of the piston valve was its perfect balance, but that a by-pass or relief valve was necessary; and the result is that one or the other of these was constantly getting out of order. The piston valve is easily disarranged because of the fact that the shopmen cut off the rings to tighten them up, changing the proportions of the valve and thereby affecting the steam distribution in the cylinders. Such a disarrangement is impossible with slide valves. He was much in favor of a new slide valve with a large exhaust opening which is now being put on the market by the American Balance Slide Valve Co. He did not believe that the clearance with the piston valve is any less than with the slide valve.

Another member gave the results of some experiments which he had witnessed on a western road, which indicated that 7½ per cent. gain in economy was to be had by the use of the slide valve. In answer to this statement Mr. Waitt thought that such experiments were of little value unless indicator cards were taken so as to show the amount of back pressure in the cylinders. It is very easy, he stated, to greatly increase the back pressure in the cylinders by restricting the exhaust opening in the piston valve, and that no doubt a properly designed valve of the piston type would work as satisfactorily as the slide valve.

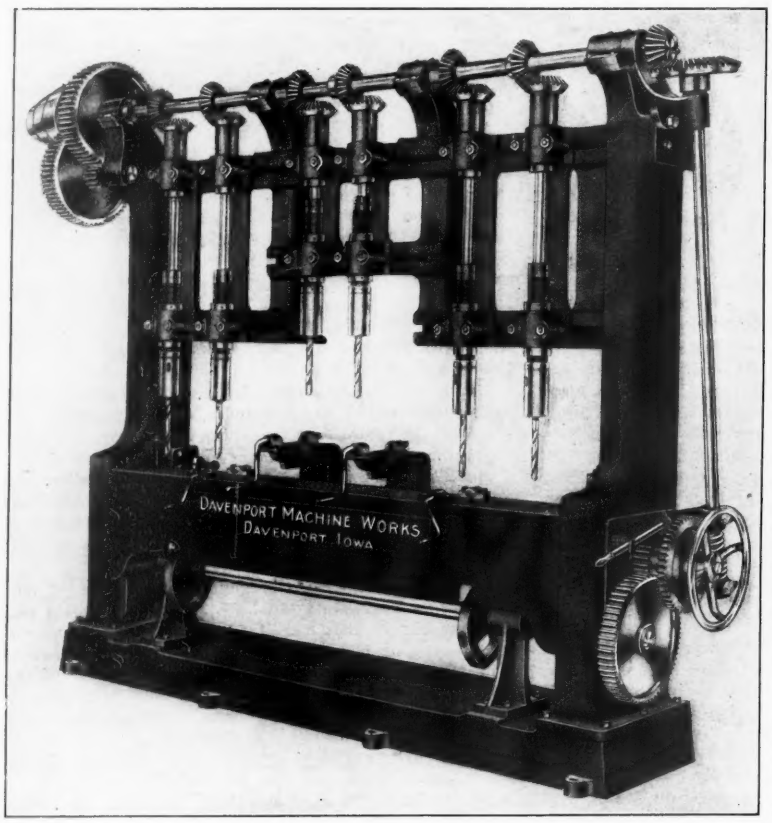
Two other subjects which were on the list, namely, "Locomotive Performance" and "Side Bearings and Center Plates," were not taken up.

Steam and Air Line Connections.—Mr. H. F. Ball, Superintendent of Motive Power of the Lake Shore & Michigan Southern and also chairman of a committee of the Master Car Builders' Association, opened this discussion by letter. He stated that the main point under consideration by the committee was the proper diameter of the pipe for steam connections. Mr. McIntosh thought that a pipe at least 2 in. in diameter should be used. It is very important to get the pipe in as straight a line as possible. He had recently examined a Pullman car which was not working satisfactorily and discovered about a dozen elbows and bends in the pipe.

The discussion gradually drifted to methods of car heating, especially the use of exhaust steam from the air pump, and there was no further discussion on pipe lines. At the conclusion of the meeting the chairman announced the list of subjects for the ensuing year. This was published in the *Railroad Gazette* February 27.

The Davenport Machine Works.

We recently published (January 23, page 68) a description of a contractors' locomotive built by the Davenport Machine Works, which is the successor to the W. W. Whitehead Company, builders of steam engines and boilers. The company has only recently undertaken the building of locomotives, and owns 5½ acres of land in the western part of Davenport, Iowa, on the Chicago, Rock Island & Pacific, with arrangements for free switching with the Burlington and the Chicago, Milwaukee & St. Paul roads. The main shop, 300 ft. long and 64 ft. wide, is well lighted and conveniently laid out. It is a single bay shop and the entire width is spanned with an electric crane serving the full length. The shafting is carried on wall brackets secured to the crane runway columns, and the tools are ranged as close to the side as possible to give freedom to the crane in handling material, machine parts, etc. The equipment includes a full complement of modern heavy machine tools.



Six-Spindle, Archbar Drill.

The forge shop is 50 x 100 ft. and has a 1,000-lbs. steam hammer, a heavy bulldozer, and furnaces for both oil and coke fuel. An Ingersoll-Sergeant compressor supplies air for pneumatic hammers, drills and riveters. The plant is lighted throughout by electricity from its own independent lighting plant.

The company is now designing and will build special heavy iron-working tools. Interesting among these is a heavy six-spindle archbar drilling machine, which is shown in the accompanying engraving. The distance between housings on this tool is 7 ft. 4 in., and its weight complete is 12,500 lbs. The spindles have vertical adjustment to allow for drills of varying lengths, and lateral adjustment for change of centers. It is provided with an automatic stop and quick return, the feed being operated by a cam at each end of the table. The table, which is counterweighted, may be raised or lowered by hand and is furnished with supports for the archbar clamping device. Six $1^{5}/_{16}$-in. drills may be run at one time with a feed of $^{1}/_{64}$ in. For lateral adjustment, between either of the end pairs of spindles the maximum and minimum distances are 25 and 6¾ in. respectively; for the middle pair, 33 and 6¾ in. respectively. The maximum and minimum distances between the two end spindles are 7 ft. and 4 ft. respectively. The vertical adjustment of the spindles to allow for different lengths of drills is 4 in., and the vertical movement of the table is 5 in.

U. S. Steel Corporation Improvements.

Announcement was made at the close of the directors' meeting, March 4, that the bond conversion plan of the United States Steel Corporation, which is now free from legal restraint, would at once be put into execution. The plan, which remains unchanged from the original proposal, and has been delayed by considerable litigation, provides for an issue of $250,000,000 in bonds, and for the retirement of $200,000,000 preferred stock. It is proposed to spend something over $36,000,000 in betterments to the various plants, and it is estimated that when this has been accomplished there will be added to the total capacity of the various subsidiary companies an annual tonnage of about 2,700,000 tons of all products; under normal conditions the increased earnings from this increased and improved capacity will be about $7,000,000 a year, and there will be a saving in manufacture of about $5,000,000 a year, or a total of something like $12,000,000 a year added to the profits of the several subsidiary companies.

A synopsis of the proposed improvements follows, with an estimate of the cost of such.

Illinois Steel Co., South Chicago, $5,075,000.—New open hearth furnace plant, blooming mill and finishing mill, at an estimated cost of $3,000,000. This plant will increase the output about 300,000 tons of structural steel, billets and plates per year. Remodeling the 132-in. plate mill train, at an estimated cost of $650,000. This improvement will increase the tonnage of plates about 70,000 tons per year. Additional heating capacity at the rail mill, at an estimated cost of $200,000. This improvement will result in increasing materially the production of rails. Improvement of the Bessemer department, at an estimated cost of $150,000. This improvement will increase the product about 10,000 tons per month. New blast furnace blowing engines, at an estimated cost of $475,000. This improvement is installed in order to increase the capacity, and this will be accomplished to the extent of about 120,000 tons per year. For repairing stoves at furnaces No. 1 to 4, at an estimated cost of $400,000. This improvement is made to rehabilitate the property. Addition to machine shop and foundry, at an estimated cost of $200,000. This improvement is made necessary by reason of the growth of the plant.

Illinois Steel Co., Joliet, $1,470,000.—Remodeling blast furnaces Nos. 1 and 2, at an estimated cost of $900,000. The improvement contemplates modernizing these furnaces in order to effect a saving in cost of manufacture of pig iron, as well as to increase the production. Addition to converting mill, at an estimated cost of $150,000. This improvement, it is estimated, will increase the capacity at least 60,000 tons a year, and, in addition, will effect a saving in cost of operation. In addition to the foregoing, sundry improvements of lesser magnitude have been authorized at South Chicago and Joliet, at an estimated expenditure of $420,000.

National Tube Co., McKeesport, $9,255,662.—The entire rebuilding of the present rolling mills and tube and pipe mills, together with the addition of one new blast furnace, an additional Bessemer converter and the installation of a new water and power plant; all at an estimated cost of $9,255,662. This improvement will increase the production at this plant of pig iron 166,000 tons per annum, Bessemer ingots 140,000 tons per annum, of the rolling mills 124,000 tons, and of the tube and pipe mills 100,000 tons. The increased earnings which will result from the additional capacity, it is estimated, will be $1,553,000 per annum, and that a saving will be effected, in cost of production, of $1,805,000 per annum.

Lorain, Ohio, $10,787,096.—The erection of two additional blast furnaces with accessory works, additional rolling mills and a new tube and pipe mill, all at an estimated cost of $8,646,096. These improvements will increase the annual production of pig iron 347,000 tons, of rolling mills 330,000 tons, and of the tube and pipe mills 300,000 tons. The increase due to additional production, it is estimated, will be $1,809,000, while the saving in cost of producing pipe, as compared with the production of an equivalent tonnage at other mills of the National Tube Company, which will be displaced by this improvement, will be equal to $1,500,000, a total gain in earnings of $3,309,000. In addition to the foregoing appropriations were authorized for the National Tube Company, for sundry improvements at its Pennsylvania department, at Pittsburg, and the Riverside department, at Wheeling, W. Va., aggregating $332,400. The increased capacity which will result from these improvements, it is estimated, will produce additional earnings to the amount of $70,000, and the saving by reducing the cost will amount to $107,000, a total gain in earnings of $177,000 per annum.

American Steel & Wire Co.—Various improvements at Newburg Steel Works, Consolidated Works, American Works, Central Works, Emma Furnace and at Central Furnace Docks, in the Cleveland district; at Shoenberger Works, Rankin Works, Edith Furnace, Neville Furnaces, in the Pittsburg district; at Waukegan, DeKalb, Rockdale, Scott Street and Anderson works, in the Chicago district, and at Worcester, Mass., works and Allentown, Pa., works, to the aggregate amount of $4,535,000. The improvements authorized as above cover additions and improvements to existing facilities, and when completed it is estimated they will effect a saving, by reason of both increased capacity and reduced cost of operating, of $1,236,000 per annum.

American Sheet Steel Co., $355,000.—The rebuilding, with modern equipment and buildings of the Canal Dover plant, at Canal Dover, Ohio; an addition to the polishing department at the Wellsville plant; the improvement of McKeesport works, at McKeesport, Pa.; the erection and installation at Vandergrift works, Vandergrift, Pa., of improved and modern operating methods; all of the above at an estimated cost of $355,000. These improvements, it is estimated, will increase the capacity about 44,000 tons per annum.

Carnegie Steel Co., at Homestead Works, $1,135,000.—The erection of an additional 140-in. plate mill, the improvement of the 32-in. mill and of the boiler plant; all at an estimated cost of $1,135,000. These improvements, it is estimated, will increase the tonnage 260,000 tons per annum and will increase the earnings about $1,440,000 per annum.

Edgar Thomson Works, $275,000.—Addition to steel and iron foundry and installation of new and modern blowing engines, in place of old and obsolete types, at an estimated cost of $275,000. This improvement, it is estimated, will increase the capacity about 116,000 tons per annum and the earning capacity about $280,000 per annum.

Duquesne Works, $330,000.—Sundry additions and improvements to existing plants, at an estimated cost of $330,000.

National Steel Co., $1,592,000.—Additions and improvements to existing plants at New Castle, Pa., Bellaire, Ohio, and Youngstown, Ohio, all at an estimated cost of $1,592,000. These improvements will increase the earnings, it is estimated, to the amount of $315,000 per annum.

American Steel Hoop Co., $285,000.—Additions and improvements at Isabella Furnace, Pittsburg, Pa., and at the Upper Union Mills, Youngstown, Ohio, all at an estimated cost of $285,000. These improvements will increase the capacity about 2,500 tons per month.

American Tinplate Co., $1,000,000.—The installation at various of its mills of modern and improved methods of operation, at an estimated cost of $1,000,000. This improvement

contemplates the installation of recently developed methods of manufacture of tinplate.

H. C. Frick Coke Co., $445,000.—The development of coke and steam coal properties, including the erection of additional ovens, all at an estimated cost of $445,000. This improvement will increase the productive capacity of coke 275,000 tons per annum, and of steam coal 600,000 tons per annum.

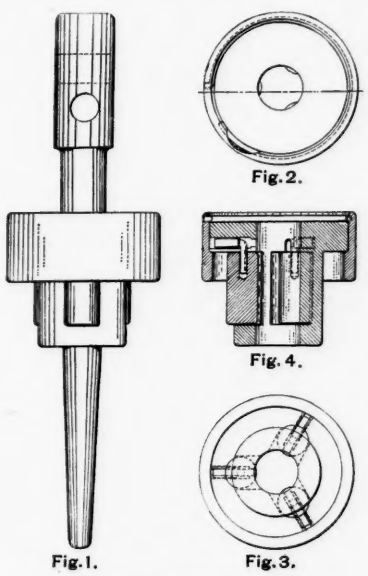
Mining Companies, $460,810.—The erection of a crusher plant at Escanaba, Mich., at an estimated cost of $143,810, with an annual capacity for crushing 510,000 tons of ore; also the erection of additional power houses, shafts and mining plants on the Vermillion, Gogebic and Menominee ranges, at an estimated cost of $317,000.

Railroads and Steamships, $1,278,961.—Duluth, Missabe & Northern Railroad, $543,961; additional locomotives, the extension of ore dock at Duluth, and sundry improvements at shops; all at an estimated cost of $543,961. Duluth & Iron Range Railroad, $187,000; sundry improvements to shops, bridges and line of road, at an estimated cost of $187,000. Chicago, Lake Shore & Eastern Railroad, $300,000; additional steel cars, at an estimated cost of $300,000. Pittsburg Steamship Co., $208,000; the installation of steam towing machines on bridges and the alteration and improvement of fleet; all at an estimated cost of $208,000. Pittsburg & Conneaut Dock Co., $420,000; the improvement of unloading machines, at an estimated cost of $40,000.

An Improved Flue Expander.

A patent on an improved flue expander has lately been granted to Mr. Arthur Munch, of St. Paul, Minn. The object of the invention is to provide improved means for holding the parts together and for guiding the pressure rollers.

Referring to the accompanying engravings, Fig. 1 shows a side elevation of the tool, Figs. 2 and 3 end views, and Fig. 4 a section through the head. From the latter it will be seen that the base of the head, which is that part above the rollers, is provided with three horizontal openings or grooves. These grooves contain each the



The Munch Flue Expander.

enlarged end of a right-angled piece designed to serve as a guide, the enlarged end having free movement within the groove. The other end of the guide fits into an opening in the adjacent roller.

Surrounding the head is a sleeve having a shoulder to fit against the enlarged part or base of the head and held in place on the latter by a wire spring fitting into a groove in the upper or outer end of the sleeve. The ends of the guide grooves are closed by this sleeve. In case of breakage the guides, being readily removable, are easily replaced.

Railroad Car Braking.*

A brake system of ideal efficiency is one in which the brake-shoes are so applied to the wheels that a retarding rail friction equal to ¼ the weight of the train is instantly realized and continuously maintained throughout the stop. In such a case, the retardation (ignoring the resistances of rolling friction and the atmosphere) is ¼ the acceleration of gravity, or 8.04 ft. per sec., which amounts to reducing the speed at the rate of almost 5½ miles an hour per sec.

The inferiority of the coefficient of friction between the wheel and the rail to that of the brake-shoe upon the wheel must be attributed chiefly to the difference in the areas of the surfaces in contact and the consequent difference in the pressure per unit area. The convenient doctrine of Morin, that the friction is independent of the areas in contact, has been the cause of many errors of construction. Mr. P. H. Dudley has clearly demonstrated that broad-headed rails yield a greater tractive power to locomotives than narrow-headed ones.

In stops from low speeds, the coefficient of friction increases, slowly at first and rapidly at the close, but continuously from beginning to end. At high speeds, the elevating influence is proportionately less effective at first, so that, for a time, the friction remains about stationary, or even declines at first before becoming stationary; but it always subsequently rises with an increasing rapidity that becomes abrupt at its termination. It is therefore a characteristic of all stops that the coefficient of friction is comparatively low during the early portion and much higher toward the close. A partial realization of the efficiency of an ideal brake system may be accomplished by using a comparatively high brake-shoe pressure during the early part of the stop and subsequently so reducing it that the high coefficient of friction near the end of the stop shall not cause the wheels to slide upon the rails. By the application of a greater brake-shoe pressure during the early period of stops the high-speed brake shortens emergency stops from high speeds to about 70 per cent. of those of the quick-action brake, or 56 per cent. of those of the old automatic brake.

The proper point at which to apply the brake, the force of initial application and each subsequent increase or reduction of the braking force are matters of personal judgment in which men differ materially; the consequence of which is that, to be safe, the brakes are usually applied too early and time is lost in drifting into the station at low speed. In an emergency application the personal element is largely eliminated, as the full application is practically instantaneous, and, where definite speed may always be depended upon, the point at which the brakes should be applied may be designated by a signal post. Thus, full speed might be obtained over much the larger part of the distance, followed by a quick stop, and fully half the time occupied by the service stop would be saved.

The application of brakes to the wheels involves a redistribution of the weight, which, where the retardation corresponds to the maximum brake application, inevitably results in a very serious loss of braking efficiency, unless means be provided for varying the brake-shoe pressure to correspond with the changed wheel pressures. The center of inertia of the car body being above the points of application of the retarding force, rotation through the eccentrically applied retarding force is prevented only by the resisting rotative moment of a greater supporting pressure from the forward than from the rear truck. Thus, the braking pressure upon each pair of wheels must be restricted to correspond with the minimum pressure of the wheels upon the rails. The effective wheel pressure, available for braking, of an ordinary eight-wheeled passenger car is but 85 per cent. of the total weight.

[The author then presents at length a mathematical discussion of this question.—EDITOR.]

The investigation disclosed the fact that a structural feature of the truck brake-gear that had been found to complicate the application of brake-shoe pressure to the wheels, might be so employed that it would serve almost entirely to recover this lost efficiency in braking. It is, in brief, the angularity of the hanger-link by which, if the brake-shoes be applied upon the inner face of the wheel—that nearest the center of the truck—and the hanger-link supporting the brake-shoe be inclined at a proper angle with the tangent to the wheel at the center of the bearing surface of the brake-shoe, the brake-shoe pressure is proportioned to the wheel pressure. This matter merits very careful consideration.

More as a matter of convenience than for any other apparent reason, it has generally been customary, in passenger car construction, to suspend the brake-shoes from the end timbers of the truck at the outer face of the wheels. It is true that the brake-shoes are thus more accessible for renewals, but the arrangement is inconvenient in other respects, requiring the disconnection and often the removal of the brake-beams to remove the wheels. The application of the brake-shoes at the outer face of the wheels results in an upward thrust of the brake-hangers, proportional to the brake-shoe friction, upon the end timber at the rear end of the truck, and a corresponding downward drag upon that at the forward end.

It has already been shown that the retardation of the car by the rail friction produces a rotative effect upon the truck, which is greatly augmented by this direct action of the brake-shoe friction through the hanger-links, and the result is that a considerable rotation or tilting of the truck frame actually occurs, compressing the forward equalizing-bar springs and relaxing those at the rear. The reaction or recoil of these springs is the cause of the frequently observed violent backward surge or shock, so disagreeable to passengers and sometimes throwing unguarded standing persons to the floor at the instant of stopping. If, however, the brake-shoes were suspended at the inner face of the wheels, the upward thrust of the hanger-links would act upon the forward portion of the truck frame, and the downward thrust upon the rear portion, so that the effect would be to counteract and neutralize, instead of aggravate, the disagreeable influence of the rail friction.

The custom of hanging brake-beams from the end timbers of passenger car trucks has been attended—in the many cases where the inclination of the hanger links is insufficient to cause the brake-beams to fall away from the wheels by gravity—by the necessary use of springs. The loss of brake-shoe pressure from the use of such springs might, of course, be readily compensated by increasing the braking force correspondingly, if such loss could be determined. But these springs vary to such an extent, even when made apparently alike and applied in the same way, that allowance for their influence is well-nigh impossible. Springs, so applied to trucks that they should keep the shoes uniformly away from the wheels, are found to operate so unevenly that, to prevent the brake-shoe at one end of a beam from dragging upon the wheel, that at the other end must be permitted to stand off so far from its wheel that excessive travel of the brake cylinder piston is necessary to apply the brakes. By the use of inside-hung brake-beams, where sufficient inclination of the hanger links insures brake-shoe clearance through the action of gravity, both the expense and trouble due to the release spring is avoided.

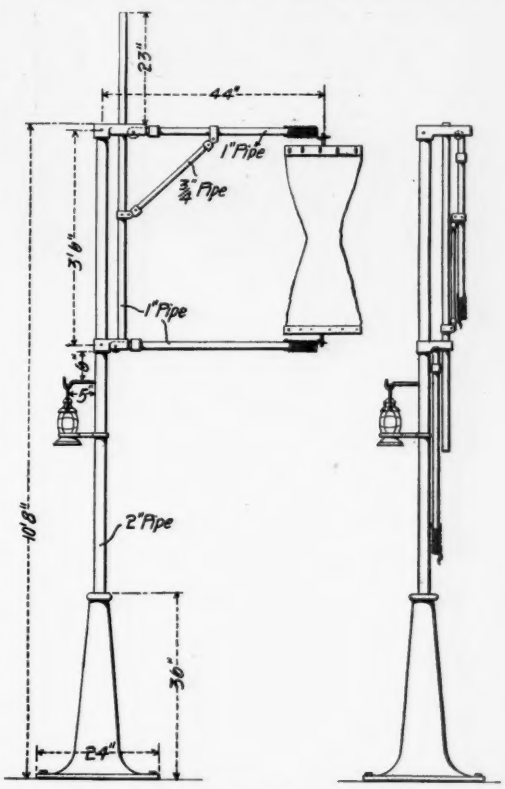
The simplicity of using the back torque of the car motors of electric railroads for retarding purposes has appeared very attractive to those unacquainted with the objection to dependence upon that means alone. But the application of electricity to the purpose of braking that appears to overshadow all others is that of the magnetic brake,* which forms part of a combined braking and car-heating system, in the latter of which the diverters of the ordinary car-starting apparatus are also used as resistances for grading the current for braking purposes and for heating the car. The heat supply is, of course, intermittent, but the heaters are so constructed that they readily absorb the heat, and gradually and continuously supply it to the car for uniform heating. In this manner the cost of the trolley current ordinarily required for heating purposes—an item of no mean proportions—is entirely removed.

The incidental features of the magnetic brake are also of interest and great value. The current declines with the speed during a stop, thereby offsetting the increased coefficient of friction at the lower speeds. In bad weather, when the condition of the rails is liable to be accompanied by wheel sliding, the braking force operating the wheel brake is correspondingly reduced, so that the force of application of the wheel brake is automatically proportioned to the rail friction which rotates the wheels. But, in addition to this valuable feature, if by chance the wheels should slide upon the rails, the interruption of wheel rotation is accompanied by the interruption of the track magnet current, through which the pressure of the brake-shoes upon the wheel is instantly relaxed and rotation of the wheels is resumed, without injury or serious loss of time.

The Barker Mail Crane.

The mail crane, shown by the accompanying engraving, is being subjected to test on the Chicago & North Western, one of them having been in service for the past five months on that road. The crane has a cast-iron base, the weight of which is about 44 lbs. The mast is made of 2-in. gas pipe. The novel features of the design are the upright member to which the upper arm is connected by a diagonal brace, and the horizontal coiled-spring supports for the mail pouch.

The two arms are hinged to swing vertically, and in



Barker Mail Crane.

placing a pouch on the crane a pole is used having a hook, in which the upper ring in the pouch is placed. The pole hook is made to engage the hook on the spring of the upper arm and the latter lifted into position. The lower arm is then raised with the left hand, and a shoulder on this arm coming under the vertical member attached to the upper arm supports the latter. The pouch is then hooked to the lower arm.

The coiled-spring supports, which are about 4½ in. long, are made sufficiently stiff to hold the sack against the draught of the passing train, but at the same time are sufficiently flexible to release the pouch readily to

*Abstract of a paper by Mr. R. A. Parke, presented to the American Institute of Electrical Engineers, Dec. 19, 1902.

*For a description of the magnetic brake see the *Railroad Gazette,* June 28, 1901, and July 26, 1901.

the catcher. The ease and flexibility of this release was demonstrated by removing at high speed a pouch from a crane having a 16 x 16-in. base, which was not bolted down. The pouch was caught without upsetting the crane. It is claimed that the action of the springs is such that the higher the speed the easier the release.

The arms are set on the mast to accommodate the shortest pouch. A longer pouch merely allows the lower arm to drop down a short distance without affecting the support of the upper arm, or lessening the tension on the pouch. This arm may drop down as much as 10 or 12 in. The position of the arms when not carrying the pouch, and which they assume immediately upon its removal, is such that trainmen are never in danger.

It is said that during the five months that this crane has been under test by the North Western it has never lost nor damaged a mail sack, nor failed to work promptly. L. W. Barker, Clinton, Iowa, is the inventor.

Improved Warehouse Truck.

The accompanying illustrations show an improved warehouse truck which has met with success since being introduced because of its simplicity, strength and adaptability to freight platform trucking. Fig. 1 is a bottom view showing the wheel arrangement and frame. The truck is balanced on the two center wheels which are placed on the outside of the longitudinal timbers, either the front or back wheel being used to give the third point of support necessary, these wheels running loose on the axle and having a side movement the full width of the space between longitudinal timbers. When making a turn, the guiding or trailing wheel, whichever happens to be in contact with the floor, slides along the axle and allows the truck to turn within its own length. The

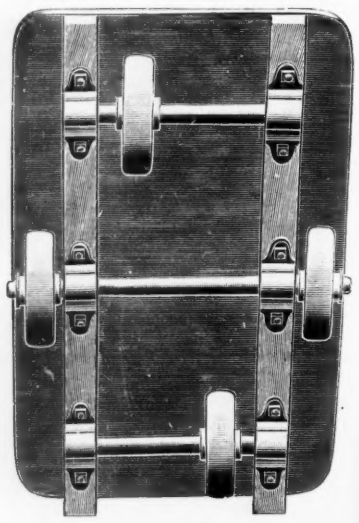


Fig. 1.

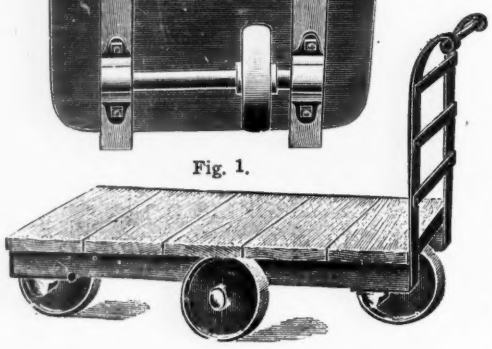


Fig. 2.

wearing parts are substantial and easy running. Fig. 2 shows one of the many forms of this truck with single end rack. They are made in sizes up to 1,700 lbs. capacity and furnished with rubber tired wheels if desired. The patentee and maker, H. C. Slingsby, has an office and wareroom at 253 Broadway, New York, for the sale of this and other specialties, including two-wheeled hand trucks, machine shop trucks to carry four tons and foundry trucks, which are made in his modern factory in New Jersey.

The Amendment to the Safety Appliance Law.

The amendments to the coupler and brake law which have been before Congress for more than a year and which were based on recommendations made in the annual reports of the Interstate Commerce Commission in 1901 and 1902, have finally been passed, after certain modifications, and the new law has been signed by the President. It reads in substance as follows:

Be it enacted, etc., That the provisions and requirements of the act entitled "An Act to Promote the Safety of Employees and Travelers," etc., approved March 2, 1893, shall be held to apply to common carriers by railroads in the Territories and the District of Columbia; and shall apply in all cases, whether or not the couplers brought together are of the same kind, make or type; and the provisions and requirements hereof and of said acts relating to train brakes, automatic couplers, grab irons, and the height of drawbars shall be held to apply to all trains, locomotives, tenders, cars and similar vehicles used on any railroad engaged in interstate commerce, and in the Territories and the District of Columbia, and to all other locomotives, tenders, cars, and similar vehicles used in connection therewith, excepting those trains, cars and locomotives exempted by the provisions of section six of said act, as amended April 1, 1896, or which are used upon street railways. Sec. 2. That whenever, as provided in said act, any train is operated with power or train brakes, not less than 50 per centum of the cars in such train shall have their brakes used and operated by the engineer of the locomotive drawing such train; and all power-braked cars in such train which are associated together with said 50 per centum shall have their brakes so used and operated; and, to more fully carry into effect the objects of said act, the Interstate Commerce Commission may, from time to time, after full hearing, increase the minimum percentage of cars in any train required to be operated with power or train brakes which must have their brakes used and operated as aforesaid; and failure to comply with any such requirement of the said Interstate Commerce Commission shall be subject to the like penalty as failure to comply with any requirement of this section. Sec. 3. That the provisions of this act shall not take effect until Sept. 1, 1903. Nothing in this act shall be held or construed to relieve any common carrier, the Interstate Commerce Commission or any United States district attorney from any of the provisions, powers, duties, liabilities or requirements of said Act of March 2, 1893, . . .; and all of the provisions, powers, duties, requirements and liabilities of said act shall, except as specifically amended by this act, apply to this act.

Pooling Engines.

BY J. V. N. CHENEY.

In the good old days of railroading, it was common to hear Smith, or Jones, tell about the peculiarities or the good points of *his* engine, and how he took care of *her* (all engines were of the feminine gender in those days). He would let the fireman handle her some of the time, but with the admonition not to break her. If they were fortunate enough to be hauling "yaller" cars (standard color for passenger cars in those days) he and Jack would show up two hours before leaving time, and Jack would go for that brass with rotten stone and elbow grease, while Jones set up all the nuts and tapped everything with a hammer to see that all was tight, then carefully moved her on and off the table, then got a run on her, backing down to the depot, so as not to soil the brass or the landscape on the headlight. These men were two of the most contented and proud mortals imaginable, *their* engine being the best on the road, in their eyes. Now, all this is changed. There are not enough engines to go around, so Smith and Jones run the same engine (if in passenger service) alternate days and neither one owns it. Should they happen to be on good terms with each other, the engine will have a fair chance of being well taken care of; that is, as well as is possible under the circumstances. The engine must make 200 to 300 miles a day, until it begins to ride like a lumber wagon, with tires flat, springs straightened out, wedges away up, and driving brasses loose. By this time it may be considered bad enough for a general overhauling, and our worthies are given another "scrap," as they will term it; and then their troubles begin. Probably the "scrap" has been a "spare" engine, and they do not spare their criticisms after making a trip. Could the "scrap" but have ears, how they would burn. Some of the remarks passed on it are: "The old 'scrap' ain't fit to haul a gravel train"; "she can't keep out of her own way"; "how that right back driving box does pound; it will lift you off the seat every time she goes over the center!" "That's right," agrees Smith. "I think she has got too much lead; and that left-hand rocker arm has got a quarter of an inch play; no wonder she goes on three legs when the valves get dry. . . . Yes! and did you notice that right main tire? I'm looking for it to roll off into the ditch almost any day, it is so thin. Well, let her go; she ain't my engine, and I can stand it if they can," ("they," in this case, being the company). And so the "scrap" is discussed and looked over. Still, there it is, waiting to be hooked to the train and make the time if it is in her. If not, why, it's her fault, of course. No business to be a spare engine. Being nobody's engine, and because it is such, Smith and Jones do as little as possible in the way of helping to keep it on its feet. And if by chance the Traveling Engineer comes to ride on it, he hears a tale of woe loud enough to rattle the reverse lever.

But, hard as it may seem to our knights of the throttle, they are positively in clover in comparison to the poor "hog backer" hauling dead freight with a "pool" engine. He comes in after being on a 24 hour trip without any sleep, except a cat-nap or two, caught on the siding or the end of the double track; is so tired he doesn't remember that pounding rod, or driving box, nor that leaking valve stem packing, to which the fireman has called his attention. Or, if he does remember them, very often he will say "to h— with her, she ain't my engine, and I may not get her again for a month!" So poor old abused 1,097 is left to the tender mercies of the hostler on the ash pit. The fire is cleaned and the blower put on full blast; and if the tubes are not already leaking, they stand a good chance of doing so by such treatment. After being coaled the engine is put into the house (if not already ordered out) with all its bumps and groans. If there is an inspector employed the engine is carefully (?) looked over; but his second sight is not keen enough to discover those pounds, or the flat wheel under the tender. If the wiper has time, some of the sand and dirt is rubbed off, the headlight (which at the time, 11 a.m., is still burning) is filled and 1,097 is again ready for business, being "five times out," which means fifth in the "pool."

At 11:30 p.m. the yardmaster telephones he wants a "jack" for a coal train, so the caller goes to West 40th street to get "Woolsey," to 39th street for "Brown," for the 1,097 at 1 a.m. In due time they reach the engine house, where they sign the register, and Brown hunts the oil cans, while Woolsey gets on his uniform and proceeds to count the wheels. Having done this he oils up, a good share of the oil finding its way to the ground from that leaking, long-nose can. However, they have all the oil they want, so a little on the ground doesn't matter. While thus engaged Brown blows her up a little, and in putting in more coal runs the ragged scoop up against that coal pit plate (which has become loose and curled up), the shock enabling him to see all kinds of stars. Finally "she" is gotten out of the house and steered through a wilderness of switch lights until a semaphore blocks further progress. About 3 a.m. there is a shouting and waving of lamps, and they back down and hook to the train. The air is coupled up, and by the time it is tested, and a few new hose applied it is 3:40 and they get the signal to go, having in the meantime put on a little more oil. On starting Brown will bar her up, but when he has got the slice bar in line he finds it so badly bent that it is useless, so Woolsey "drops her down" to "hook her up" for Brown. But she won't steam, and Brown bets a four dollar bill half her tubes are plugged up, which is doubtless the case. Arriving at the first water plug, one main connection is found to be smoking, and is promptly put in position and the plug turned loose on it, (I have seen this done) while Woolsey says unprintable things about Smithers, who failed to fill those cups as he was supposed to do. While Brown is trying to shake the grates, one of which has become disconnected, Woolsey takes off the oil cup and puts a piece of soap into the hole in the strap, fills the cup and they are ready to start again.

Arriving at the Meadows, they find themselves to be first out, but the engine is left in the house, as there has been one put into the ring, having just come from the shop, after a few minor repairs. The piece price system being in vogue on this road, one is not sure of getting a prize until he finds out.

After the usual preliminaries they get started on the return journey, poor Brown working hard in a vain attempt to keep the pointer of the steam gage on the right side. He tries all kinds of fires, both heavy and light, but still the pointer persists in leaving the wrong way. At every stop his friend, the "blower," is called on, and the start is made in good style, but still the pointer leaves the wrong way. After a good portion of the run is made Woolsey begins to think that either Brown or the engine is at fault, so he takes the scoop to try his luck at keeping the pointer in the right road, but vain hope; it is obstinate, and refuses to stay where the blower puts it. Finally Woolsey comes to the conclusion the exhaust pipe must be leaking at the cylinder saddle joint, and they peg along as best they can. He finally reports the engine not steaming, "examine exhaust pipe joint," and if this proved to be the case, it was leaking badly, and "piece work" had some unkind remarks said about it.

A crew is ordered for No. 6 and "Tom" and "Jack" (myself being the Jack) are the winners of this prize. No. 6 is called a "Jack" (no relation to me), and is duly hooked on to 50 loaded coal cars, and the semaphore being turned "white" we stagger by the "Zoo" and are off; No. 6 steaming in fine style, the leaky tubes having been coaxed into holding the water for the time being. Arriving at the "Junction" Tom gathers up the long oiler, a hammer, and a wrench, and climbs down on the ground and addressing the left main connection, says Blank. you, you are not going to bother me all this trip as you did the last. ! ! ! ! ! He then loosens the set-screws and slacks up the key, sets up the screws, and is ready to go. He has forgotten to open the cylinder cocks while standing at the "Junction," but a little water does not hurt No. 6, and "she ain't my engine." The conductor comes over ahead, and takes the throttle, while Tom takes his position on the running board, tallow pot in hand, and that brass gets plenty of oil for that trip. Arriving at the "Junction" on the return trip, Tom gets down with the hammer and wrench, and the performance with the connection is reversed, and No. 6 is put in the house ready for the next victim. How he fared I never learned, but one's imagination can supply a picture.

Sometimes (on being called for a trip) the engineman would find in the register book a notice reading, "left main rod brass has been reduced; look out for it"; but I doubt if many had as faithful looking after as that one of No. 6. Such fatherly care is seldom accorded a pool engine.

One night on the trip out my attention was attracted by an engine, coming in the opposite direction, with what appeared to be two headlights. A queer deal, thought I; but on passing the engine I found I had been mistaken. There was but one headlight, but the front door was red hot. It loomed up in great shape on a dark night. On another occasion I was firing 1,096, and while standing on a siding my partner took occasion to look at the fire, remarking it was a good "jack" fire. I thought I was doing well; the engine steamed all right, but why should it not; it had a fire in each end. Through the cracks in the blistered front end sheets I could see the sparks all on fire. But she wasn't *our* engine, we might not get *her* again for a month; besides, the company was rich. Any road must be, to afford to run "pool" engines to that extent, no wonder blower and other pipes in front end have to be renewed frequently.

Imagine the great waste of fuel attendant on

such conditions. These are not dreams that I am telling, but positive facts. Take the case of No. 6; a key slacked up and the engine run in that condition 25 miles, bang, bang, at every revolution, and the wheels being small the revolutions were quite numerous. Pounding rods are in evidence everywhere. You hear them on the crossings, at the coal yards, and at all sorts of places. One may observe all degrees, from the gentle little thump to the good old solid bang, that lifts you off the seat at every revolution. Gage cocks are often a delight on the pooled engine. One takes an engine out to take a train; on trying the water, he gets, after much difficulty, the bottom gage cock open; then he wishes he hadn't, for it refuses to close. Or, if the engine is provided with a water glass, it breaks, and instead of closing automatically as it is supposed to do, the water cock persistently sprinkles the immediate vicinity with hot water, and after a time he gets it partly shut off. "The other fellers" (perhaps he was one of them) had neglected to blow the glass out occasionally, and keep the seats clean, so they could work when necessary. I have seen water glass connections clogged until there was an opening in them scarcely large enough to see through. What reliability can be placed on water levels shown under such conditions?

These are but a few of the many things the "pool" engineman has to put up with. And yet the Traveling Engineers' Association put up such arguments as that a shop man would not be a suitable person for engine inspector because he would not know just how long it would be safe to let a defect go, before repairing it. Again, I have heard enginemen complain that the brake-valve worked so hard it was necessary to use their foot to release it. "But why did you not oil it?" "Oh, I ain't oiling no brake-valves; she wasn't my engine." I could get along with it. But you could make better stops then. Well, if it suits them, it suits me, and I knew I would not get *her* again. So, in all probability he does not report it, on arriving at terminal, and the next victim does the same, and so it goes indefinitely. Yet in the face of all this, pooling seems to have come to stay, no matter whether or not the engines stay. Nowadays engines cost a great deal more than formerly, as with increased steam pressures, boilers must be built stronger and heavier, cylinders must be made thicker; in fact, everything in proportion, and the end is not yet.

New Compound Engines for the Midland.

The Midland Railway (England) has now had at work for some months a new type of express engine. The system is that of Mr. W. M. Smith and was tried some years ago on the North Eastern. Since that time many of the details have been improved and the boiler pressure has been increased. A number of special features have been incorporated in the design of these locomotives, chief among which is the ability to be worked either as simple engines, semi-compound or compound engines. Three cylinders are used, all being connected to the leading driving axle. The inside high pressure cylinder is 19 in. x 26 in. and the low pressure cylinders are outside of the frames and are 21 in. x 26 in. The boiler pressure is 195 lbs. and when working compound steam is admitted directly to the high pressure cylinder and is exhausted without any intervening pipe into the low pressure steam chest. A valve on one side of the smoke-box permits live steam from the boiler, reduced in pressure, to enter the low pressure steam chest. This valve would only be used in starting and can be controlled by the engineman. Whenever the maximum allowable pressure in the low pressure chest is reached the supply from the boiler is automatically cut off.

One of the new engines has Serve tubes with a total of 1,570 sq. ft. of heating surface, and the other, with plain tubes, has 1,448 sq. ft. of heating surface. A Belpaire fire-box is used and has a grate area of 26 sq. ft. Both engines have Mr. Smith's patent piston valve fitted to the high pressure cylinder, and is driven by ordinary link motion. This valve was very satisfactory on the North Eastern engines previously referred to, and it is claimed that under certain conditions the fuel economy was increased by 13 per cent. over an engine doing the same class of work but provided with slide valves of the usual type.

The total weight in working order is 59½ tons, with 38¾ tons on the drivers. The drivers are 7 ft. in diameter. The tender has a tank capacity of 4,500 gallons.

One of these engines has run the 76¾ miles from Hellifield to Carlisle in 79 minutes with a load of 210 tons. This section of the road comprises many miles of grade of 1 in 100. Loads of 270 tons have been taken unassisted over the division.

An edge or rim is fitted to the front of the stack to prevent the wind from blowing down. This was made necessary owing to the fact that part of the road is at a very high elevation and much exposed. Tail rods are provided on the low pressure pistons. It is worthy of note that these engines are the first outside cylinder main line engines used by the Midland. They have been built at the company's works at Derby. A general description, applying to both engines, follows:

Description.

Weight on drivers	86,800 lbs.
Weight on truck wheels	46,480 lbs.
Weight, total	133,280 lbs.
Weight tender loaded	117,780 lbs.

General Dimensions.

Wheelbase, total, of engine	24 ft. 3 in.
Wheel base, driving	9 ft. 6 in.
Length over all, total, engine and tender	60 ft. 10 in.
Height, center of boiler above rails	8 ft. 6 in.
Heating surface, fire-box	150 sq. ft.
Heating surface, total	1,570 and 1,448 sq. ft.
Grate area	26 sq. ft.

Wheels and Journals.

Drivers, number	4
Drivers, diameter	84 in.
Truck wheels, diameter	42 in.

Cylinders.

Cylinders, diameter	19 in. and 21 in.
Piston, stroke	26 in.

Boiler.

Boiler, working steam pressure	195 lbs.
Boiler, diameter of barrel	57⅛ in.

Fire-box.

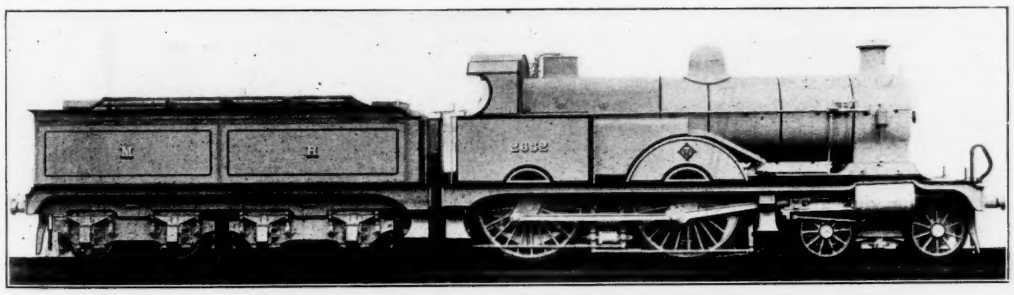
Fire-box, length	7 ft. 9 7/16 in.

Tubes.

Tubes, outside diameter	2¼ in. and 1¾ in.
Tubes, length over sheets	11 ft. 7 in.

Tender.

Tank capacity for water	4,500 gal.



Compound Express Locomotive for the Midland.

The Engineer of the Twentieth Century.*

. . . Compare conditions then (50 years ago) with those now. Note what the engineer has done since some of those present reached middle life. Who will venture to predict what we young men may see before we become old? It is with pride that I see how my own city—the Smoky City of the Keystone State, the city of engineers and of industry—is growing in influence. A week ago a Philadelphia paper quoted a multi-millionaire thus: "Pittsburg, instead of Wall Street, must be considered hereafter as the potent factor in the continuation of our national prosperity." When money rates go up in Wall Street and wage rates go up in Pittsburg simultaneously, it is the industrial thermometer which most truly indicates the real prosperity. Enter Engineer; exit Speculator.

It is significant also that the response to this toast is assigned to the representative of the American Institute of Electrical Engineers. This organization represents the electrical engineers of America—the country above all other pre-eminent in electrical activity—at a time when its applications are making this the Age of Electricity. For a retrospect of general engineering we appeal to the memory of men past middle life; but the electrical awakening is within the easy memory of us all.

Electrical work is seldom independent. It does not stand alone, complete in itself. Electricity is usually an instrument, a means to an end. It is not energy derived at first hand from electricity which enables the car to move and the crane to lift a weight. It is power derived from the engine, which happily can be transmitted by electric wires better than by shafts or ropes or belts. It is because electricity is primarily an agent, a means, that its applications have been so diversified, so extensive, and so far reaching in their effects.

The electrical engineer follows a new gospel—the gospel of service. His mission is helpfulness. Through his aid the mining engineer lights his mine, drives his fans and pumps and drills and conveys his product. Through his aid the mechanical engineer has modernized the machine shop by the electtric crane and by motor-driven tools which increase output and reduce cost. Through his aid the railway engineer has replaced the horse car by the people's automobile, which for a few cents will carry anybody from city to suburb more quickly than it was possible by any means at the command of even the millionaire a dozen years ago, and that, too, with the added comforts of warmth and light. Through his aid the luxuries of yesterday have become the necessities of to-day, and the impossible has become the commonplace.

*Extracts from a response to a toast at the twenty-fifth anniversary of the Engineers' Club of Philadelphia. By Charles F. Scott, President, Engineers' Society of Western Pennsylvania, and of the Amer. Inst. of Electrical Engineers.

The great discovery of the nineteenth century was co-operation, the effectiveness of concentration, the efficiency of largeness. Compare the old days of the hand-loom in the home, of the shoemaker at his bench, of the individual oil well and coal mine, of the small railroad and of the small factory—compare these with modern methods, pregnant as they are with unbounded possibilities—possibilities of good and possibilities of evil; of good, because the engineer has provided the means for doing the world's work far more efficiently; of evil, because the social, the industrial, the commercial systems have not kept pace with the advance made by the engineer, but are still tainted with injustice and selfishness.

The tendencies of the nineteenth century projected into the future reveal, in dim outlines at least, the engineer of the twentieth century. He is to deal with large affairs in a large way. He is to be closely related to every department of modern life. He is to become a chief factor in adjusting and operating the intricate mechanism of a new civilization. He is to advance to administrative positions for which his knowledge and his training peculiarly fit him.

Besides their new relations to others, there will be new relations of engineers among themselves. All that I have said so far emphasizes what we all know, namely, that the several branches of engineering are intimately interdependent and correlated. Take a single instance of large work, the extension of the Pennsylvania Railroad into New York City—the tunnels under the Hudson and East Rivers, the terminal facilities and the electrical equipment—and endeavor to name an important branch of engineering which is not essential to this undertaking. The work of the future demands co-operation, not clannishness; unity, not jealousy. Engineers must be specialists; therefore they must work together. The several branches of the profession have their individual interests; they have a larger common interest.

There are national engineering organizations of various kinds—the civil engineers, the mining engineers, the mechanical engineers, the electrical engineers, the architects, the naval architects and marine engineers, the engineers in the army and the navy, and there are the chemists, the electrochemists and others. In general each knows that other societies exist, and they are mutually respectful; but there is some suspicion here and there that the others are a little too exclusive or that they are a bit jealous. These are the murmurings of littleness, not of largeness.

An incident of the past year is an auspicious omen. Four great societies have co-operated; they have taken a step which will bring recognition to the deserving individual and credit to the engineering profession. They have founded a medal; and at a recent magnificent dinner they have announced the award of the first John Fritz medal to the venerable man who has just spoken, John Fritz himself. But not less significant than even the medal is the discovery that the societies can work together, and that by doing so they can accomplish worthy ends.

Years ago engineers were individuals of trivial consequence compared with men in the learned profession. Now they, too, form a profession of recognized importance.

But . . . have the engineers themselves fully recognized their own strength and importance? Have they shown a disposition to act together, to do large work in a large way? Have they given promise that they would use the enlarged facilities in such a way as to increase the efficiency of engineering work?

The men who are mastering the powers of nature will yet rise in the strength of united effort to meet the increasing responsibilities of the coming years. For it is theirs to build the foundation of the new civilization; it is theirs to establish that material prosperity which is the underlying condition of broader, higher and fuller life.

The end of engineering is usefulness; the characteristic of America is activity; the modern method is co-operation. As engineers of the twentieth century, let us be useful; let us be active; let us co-operate.

The London & North Western's Annual Report.

The statement of the earnings, expenses, etc., of this road for the year ending Dec. 31, 1902, compared with the previous year is for many reasons interesting:

		Increase.
Earnings—		
Passengers, mails, etc.	£6,166,428	£111,782
Freight and minerals	7,881,649	240,507
Other sources	442,513	10,225
Gross income	£14,490,590	£362,514
Expenses—		
Chief rents, leases, etc.	278,262	*6,823
Operating, taxes, etc.	8,959,230	78,967
Gross expenses	£9,237,492	£72,144
Balance	£5,253,098	£290,370
Deb. stock, 3 per cent. per annum	1,087,334	5,095
Pref. stocks, 4 per cent. per annum	1,565,849	38,609
Consol. stock, 6 per cent. per annum	2,572,398	214,466
Total of these stocks	£115,678,021	...
Total dividends	£5,225,581	£258,170
Surplus balance	27,517	...
Surplus balance (1901)	75,351	...
Gross surplus balance	£102,868	...

* Decrease.

A summary of the year's operations translated into dollars will perhaps be more readily understandable. With a capital account of 560 million dollars this company earned net over 25 millions and divided it all except $133,000; and has a gross surplus balance of less than half a million dollars; less than one-tenth of 1 per cent. of the capital stock.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
At 83 Fulton Street, New York.

EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

When this issue of the Railroad Gazette is in the hands of its readers, its office will have been removed to 83 FULTON STREET, at the corner of Gold street, east of Broadway.

The long-pending amendment to the Federal safety appliance law has been adopted, and its provisions are given in this issue. The sum of it is that after September 1, 1903, all vehicles—not cars alone—must have automatic couplers, and that at least half the cars in every train must be air-braked. The Interstate Commerce Commission has power to require more than half. These main features are fortified by clauses of a sweeping nature. Every engine, tender, snowplow and caboose must have automatic couplers. To use diverse couplers as, for example, a Janney and a Miller, in the same train, will be a violation of the law. The Act applies not only to cars used in interstate commerce but to all cars used in connection therewith; which means everything on an interstate road. To hold trains wholly by hand brakes, as is now done by some roads on steep descending grades will be unlawful; as also it will be to use, say, only 25 cars in a 50-car train when there are 10 other air cars which might be used. The clause in the bill which authorized the Interstate Commerce Commission to relieve a road from the 50 per cent. requirement was stricken out; but as the original law, still in effect, empowers the Commission to extend the period within which any road shall comply with the law, it would seem to be within the power of that body to postpone the enforcement of the 50 per cent. requirement.

The Constitution of the United States says that "the Congress shall have the power to regulate commerce with foreign nations and between the several States," and the Supreme Court in deciding last week the "lottery cases," has put beyond question the full meaning of the word, "regulate." Congress may regulate, may restrict, may prohibit. Regulation means full control to the extent of prohibition. Most railroad officers and laymen who, in their simplicity, take words and sentences at their face value have prejudged this case and had no doubt that Congress had this power. To us the wonder is that only five members of the Supreme Court agree with us; while four of these judges differ. To the practical man interest in the law is apt to be limited to the application of it. It is not onerous to comply with an order to refuse to carry lottery tickets; it would not be difficult to obey an order to refuse accommodations for baled hay or for monkeys; but it would be both onerous and difficult to obey a law prohibiting transportation of goods made by a corporation which had failed to comply with some other law. It was this provision of the Littlefield bill which made it revolting to one's sense of justice and of proportion, although it would have been strictly constitutional. That it was proposed and that it might have been is not a reflection on the makers of the Constitution which authorizes it; its failure is rather evidence that the power to regulate interstate commerce is safely entrusted to Congress.

In Mr. R. A. Parke's paper, "Railroad Car Braking," in another column he discusses the merits of the magnetic brake, which is operated in conjunction with the car heating system. During the period of retardation the motors act as generators for energizing the track magnets and the surplus energy is diverted to heating coils within the car. Mr. Parke says that the economy to be effected by this one item alone is great. It is estimated that about 15,000 British thermal units per hour are required to heat an electric car such as is used by the Manhattan Elevated of New York. At present they are heated by electric heaters which take their current from the main circuit and hence require a constant expenditure of energy at the power house while in use. One pound of good coal contains about 14,000 thermal units. Something like 35 per cent. of this passes up the chimney at the power house, leaving 9,100 units in the steam. If 100 units are lost in the steam pipes by radiation and the thermal efficiency of the triple expansion engines is 20 per cent., we have left but 1,800 units delivered to the generator. Assuming again that 10 per cent. is lost in the generator and that 50 per cent. of the remainder is lost in the transmission system before reaching the heater, we have but 810 units, of the original 14,000 units, available for heating. If the heat in each car is used for 100 days during the year and is kept on for 20 hours during each day, a calculation shows that about 19 tons of coal are consumed in the power house in that time. With coal at $2 a ton the cost of heating one car during the season is $38, while the magnetic brake and heater reduces this cost to zero.

Elsewhere in this issue is published a description of a new tank car which is notable for simplicity of design. In some respects it is similar to the Vanderbilt design of a year or more ago, in that in the latter, while there are two I-beams extending the entire length of the car to stiffen the shell, the principal support for the tank is at the bolster castings. In the Van Dyke design intermediate supports for the tank between bolsters are entirely eliminated, reducing the essential parts to a minimum. While it might be expected to have the effect of reducing the weight of the car, expressed in terms of pounds per gallon of tank capacity, this has not actually been the case, the result no doubt being regarded as secondary to the importance of having a sufficiently heavy construction to withstand successfully the severities of service. A not uncommon difficulty with the type of tank car having wooden head blocks results from the crushing of the blocks by the tank heads, caused by the shocks of service. Longitudinal movement of the tank follows, straining the joints and starting leaks. This trouble is overcome in the Van Dyke design. The safety valve is about nine times larger than the valves heretofore in general use on Union Tank Line cars. This possibly indicates that either this is a matter that was neglected before, or else that the requirements governing the proportions of a valve for this purpose were not properly understood. According to the designer, the valve is estimated to be able to exhaust 10,000 gals. of 80 deg. Beaumé oil converted into vapor at 35 lbs. gage pressure in 2¼ hours; the assumption being that the tank might be enveloped in flames and allowing 8 sq. ft. of surface to the horse-power. Accepting this valve as being of correct proportions, it is not pleasant to contemplate the possible results with the old form in an emergency such as that assumed in this estimate.

Perhaps the most notable result of operation reported by the Pennsylvania Railroad Co. for 1902 is that gross earnings of the main line between Philadelphia and Pittsburg were at the rate of $149,128 per mile—that is, two and a half times the average cost of railroads in the United States, and at least 18 times their average gross earnings. The freight traffic, which yielded 78 per cent. of these earnings, was at the rate 23,764,530 ton-miles per mile of road, which is equivalent to a movement of 32,554 tons each way daily. Were this traffic carried in trainloads no larger than the average in this country (which is by far the largest in the world), more than 130 trains daily in each direction would be required to carry it. This traffic is some 30 times as great as the average on American railroads, and doubtless is equaled on no other line of equal length in the world. Main-line traffic is rarely reported separately, so we cannot speak positively. The facts are important as indicating the limits of the capacity of a railroad, which were reached on the Pennsylvania last year for considerable periods on this part of its system. Other comparisons, equally striking, can be made by comparing this year's net income with the company's capital after it shall have been increased by the proposed new issues. The net income in 1902 was equal to more than 12 per cent. on the $204,374,850 capital stock outstanding, and over half of this money was spent for betterments and new equipment. During 1903 it is proposed to raise $67,000,000 for important additions to the lines east of Pittsburg (not including the New York tunnel), and holders of the $50,000,000 convertible, 3½ per cent. bonds issued to pay for the New York tunnel and terminal will be allowed to exchange them for stock on a basis of $70 for each $50 share. Assuming that the entire required funds can be procured at the same rate, the $117,000,000 would be represented by $83,571,400 new capital stock. Disregarding entirely the tremendous increase in earning power due to the improvements—an increase which can scarcely be estimated—the net income for 1902 would have sufficed to pay a dividend of over nine per cent. on the entire capital stock, old and new.

The Pennsylvania Improvements.

That part of Mr. Cassatt's annual report which describes the betterments made during the past year and the "improvements absolutely necessary to promptly and economically handle the present volume of traffic and meet the demands of the next few years of active growth" is a magnificent exhibit of stupendous railroading. It is easily the largest work ever undertaken for additional facilities to an existing line. The need for it, the plans for it in reasonable detail, and the company's duty to the public are given in as few words as it is possible to express them, and with abounding confidence in the approval of 29,000 stockholders. It is difficult to give an adequate notion of the undertaking in less words than the President uses, but expressed in dollars it is as follows:

Revision of grades and alinement, abolition of grade crossings, etc., and new equipment east of Pittsburg, done in 1902	$25,874,276
Similar expenditures on branches in 1902	5,341,630
Estimated cost of improvements east of Pittsburg, requiring from two to three years to complete	67,000,000
For the two double-track tunnel lines under New York City and the city station	50,000,000
Total	$148,215,906

The cost of the last item is not so stated in the report; it is an assumption. It is notable that $12,500,000, about one-half of the first item in the above list, and about one-twelfth of the whole cost of the undertaking, was paid for out of the net earnings of last year, and was not charged to capital account. That is, the company earned about 12 per cent. on its stock, paid 6 per cent. to the stockholders and applied the balance to capital expenditure. This is in accordance with the company's policy for many years, although it has occasionally met with remonstrance from foreign stockholders. This huge expenditure also shows to what an extent the improvement of old lines in this country has taken the place of the construction of new ones. We no longer build 8,000 to 12,000 miles of railroad in a year, as in the eighties, but we are investing vast amounts of capital in improving the old ones, increasing their effectiveness, in many cases, much more than if they were duplicated at five times the cost.

What capital and brains can do in the way of surmounting obstacles is shown by the fact that when the purposed improvements are completed the Pennsylvania Railroad crossing the Allegheny mountain range will have a line between Pittsburg and New York with a maximum grade of only 15.8 ft. per mile, with the exception of 24 miles with a grade of 52.8 ft. This mountain railroad will then have become a low-grade railroad—much lower than most railroads in the prairie States.

An examination of the details of these expenditures already made and proposed to be made shows that a considerable proportion may not be expected to give a present adequate return on the investment, either in a reduction of expenses or in increased earnings. For example, the company proposes to own such a number of locomotives as can handle without delay all possible business in even an exceptional period of industrial activity, and during the long intervals to store this not needed power, protected from rust with paint and grease, its capital inert. Duty to the public, recognized and provided for without prodding by the public, is evidently a matter of high consideration in such large plans for surplus rolling stock, for costly abolition of grade crossings and the like.

Nevertheless, if the lessons of the year 1902 mean anything for the future it is clear that 150 millions spent as planned will, as a whole, not only make a reasonable return on the investment, but it will also be a guarantee of continuance of something like the present rate earnings on the capital. Such guarantees are needed if commercial history is a guide to the future.

Has the year's work developed a new law in railroad operation? The President says that the remarkable development of business created a demand for transportation which the company could not supply; that, although they had enough locomotives and cars to have, possibly, moved the traffic offered, nevertheless their inability was due mainly to lack of track and yard facilities, and he adds that experience has shown that yards may become *too large* for the prompt and economical movement of traffic! This is a suggestive theme that will have consideration. The plans adopted for avoiding too large yards by classifying and dividing traffic in the new line around Pittsburg, with new yards at Sharpsburg, Brilliant, Shire Oaks and Ormsby, and for like improvements all along the line, are radical and comprehensive. The next issue of the *Railroad Gazette* is expected to contain the first installment, by Mr. S. Whinery, of a series of articles showing the kind of enlargement of facilities needed for the growing business of this great railroad.

With due reverence and with abounding enterprise Mr. Daniels continues his discoveries of the New York Central passenger department's development of Biblical prophecy. Our important contemporary, the *Four-Track News*, reprints his Yonkers after-dinner sermon, with a text from the prophecy of Nahum (Chap. 2, verse 4):

"The chariots shall rage in the streets; they shall jostle one against another in the broad ways; they shall seem like torches; they shall run like the lightnings."

Brother Daniels held himself firmly in check and did not use the prophet's imagery to advertise the Empire State Express, as he did when he dispensed with the gospel in his Murray Hill address to the General Passenger Agents' Association. He makes a general application of the words of holy writ, and any little one-horse railroad will be at liberty to avail itself of the advantages and emoluments arising from this interpretation of a mystery that has puzzled a hundred generations of men. Mr. Daniels says that the prophet evidently referred to automobiles. This certainly is a happy thought for an after-dinner speech. He will not irritate his competitors, as he would if he were to try to apply the mystic words to the locomotive; or to dining cars, of which he has 28 constantly in service, filling every other G. P. A. with envy; and he will mightily please the wayfaring man. Indeed, this inspiring Scripture arouses a hope that the devilish automobiles, which race up and down Fifth avenue, rivaling the 20th Century Limited in speed, will yet jostle each other off the earth and give the meek pedestrian a chance to live. In the dark ages, before the advent of the Janney coupler, students of prophecy applied these words about the jostling chariots to ordinary passenger cars. These men interpreted according to the best lights they had, and it is not for us to reproach them. The cars certainly did jostle fearfully, sometimes, and it is a wonder how we ever had the fortitude to put up with the old, loose coupler so many long years. But the dead past may now be buried; the modern wide-vestibule Pullman compartment observation, dining, sleeping, café and reading-room car, and other cars with American adjectives, are never known to jostle or rage. It is the automobile that the prophet foretold.

A threatened strike on the Wabash Railroad has been averted by the unusual process of an injunction from the United States Circuit Court; at least, this is the situation as reported in despatches from St. Louis as we go to press. For some time the trainmen on the Wabash lines east of the Mississippi have been in conference with President Ramsey concerning their desire to get the same pay that is given by the company for similar work on the lines west of the Mississippi, and it is said that when the matter finally came to a vote last Monday the conductors and enginemen decided not to strike, while the firemen and brakemen voted by a considerable majority in favor of striking. On receiving these decisions Mr. Ramsey appears to have gone immediately to Judge Adams, of the Federal Court, and asked for an injunction. The writ was at once issued. It commands the officers of the trainmen's and firemen's brotherhoods and all who are aiding or abetting them to desist from in any way ordering or persuading the employees of the Wabash to strike or quit the service of the company. The company has recently raised or promised to raise the pay of the trainmen west of the river to correspond with increases made by other companies in that territory; and the reports indicate that President Ramsey has offered to follow the same rule east of the river—that is to say, to pay as high wages as are paid by any other road in the same territory.

The coming enlargement by the New York, New Haven & Hartford Railroad of its power house at Berlin, Conn., and great extension of the current from that point suggest as a near probability the electrifying of additional steam railroad lines of this company to meet existing trolley competition. The most likely project is a third rail between Hartford and Rockville, a distance of about 18 miles. The steam passenger traffic between these two cities was almost swept away by a trolley line opened a few years ago, and, as the steam company operates a double track over all but about four miles between Hartford and Rockville, the plan appears perfectly feasible. It would be a duplicate (on the east of Hartford) of the successful third rail on the west, between Hartford and Bristol. It has been announced already that, with its new power, the company expects to operate its Meriden city street railroads. With this addition the New Haven company will be operating over 100 miles of former steam track electrified, besides 88 miles of ordinary street railroads bought up or built to thwart trolley parallels.

The Pennsylvania Annual Report.

The general income account for the lines directly operated, aggregating 3,705 miles, as against 3,739 miles in 1901, shows the following figures:

	1902.	1901.	Changes. Increase.
Gross earnings	$112,663,330	$101,329,795	$11,333,535
Operating expenses	75,051,071	65,259,543	9,791,528
Net earnings	$37,612,259	$36,070,252	$1,542,007
Rentals paid	6,657,421	9,663,450	*3,006,028
Net oper. exp.	$30,954,837	$26,406,802	$4,548,035
Other inc.	9,039,877	8,584,914	454,962
Gross inc.	$39,994,714	$34,991,716	$5,002,998
Interest, taxes, etc.	14,144,750	12,797,386	1,347,365
Net income	$25,849,963	$22,194,330	$3,655,633

* Decrease.

After deducting $12,500,000 from the net income for extraordinary expenditures in betterments, and $12,262,491 for the 6 per cent. dividend, a balance of $550,943 was carried to the profit and loss account, making the latter $24,742,224.

Comparative figures for the entire system, both East and West of Pittsburg, including the directly operated and also the affiliated lines, show the following results:

	1902.	1901.	Increase.
Miles	10,784	10,485	299
Gross earnings	$219,849,864	$198,626,878	$21,222,986
Expenses	152,220,272	133,713,386	18,506,886
Net earnings	$67,629,593	$64,913,492	$2,716,101
Other income	16,254,710	14,072,029	2,182,681
Gross income	$83,884,303	$78,985,521	$4,898,782

GENERAL REMARKS.

The report of the managers of the trust created Oct. 9, 1878, shows that there has been paid to this trust by the company to Dec. 31, 1902, the sum of $5,146,319, that on that date securities amounting at par to $11,546,230 were held in the trust, and that the total income therefrom has been $9,049,640. There was appropriated to the trust for the year 1902 the sum of $129,429, and the interest received on securities held in the trust during the year averaged about 4.6 per cent. on their cost.

The statement of the insurance fund shows assets on hand at the end of the year of $4,968,636, being an increase, as compared with 1901, of $105,033.

The membership of the employees' voluntary relief department of the Lines East of Pittsburg and Erie aggregated 70,307 at the close of the year, being a gain of 10,637 members, as compared with the previous year. During the year the members contributed $1,061,103, while your company and its affiliated lines paid $164,446 for operating expenses. The total receipts of the department, including interest and other items, were $1,310,604, which, with $357,269, the balance on hand at the beginning of the year, made an aggregate of $1,667,873, out of which $467,884 was distributed as death benefits (being an average in each case of about $560), and $652,857 in cases of disability arising from sickness and accident. After meeting its obligations for the year, a balance of $382,687 remained to the credit of the fund, from which must be paid unadjusted claims for benefits growing out of sickness or accident during 1902 and previous years. In addition to this balance there is a surplus which has accumulated during the life of the fund, amounting to $751,256, which has been invested in securities yielding a return of 4 per cent. upon their cost.

The statement of the employees' saving fund shows that the number of employees who availed themselves of its benefits continued to increase, there being 7,997 at the end of the year, a gain of 942 over the preceding year. The balance in the fund, at the close of the year, was $3,408,250. Of this amount, $3,300,000 has been invested in securities, bearing interest at an average rate of over 3½ per cent.

The pension department is fully meeting the purposes of its organization, and its requirements are satisfactorily met by the increased appropriation thereto authorized at the last meeting of the shareholders. During the year there were retired 133 employees who had reached the 70-year limit, and 94 employees between 65 and 70 years of age, who had been over 30 years in the service and were incapacitated for further active work. Of the employees who had been formerly retired, 131 died during the year, so that there are now carried on the rolls 1,017 employees over 70 years of age and 184 between 65 and 70 years of age. The amount of allowances paid during the year was $265,113.

The tunnel extension into New York commences at a point on your United New Jersey Railroad about a mile east of Newark. . . The necessary authority from the States of New Jersey and New York for the prosecution of this enterprise was readily obtained, but the inception of the work was delayed by the inability to procure the requisite legislation from the municipal authorities of the city of New York. The franchise for this purpose, which was promptly granted by the Board of Rapid Transit Railroad Commissioners, had also to be approved by the Board of Aldermen, but it was only on Dec. 16 last that that body took affirmative action.

A large proportion of the real estate required for the construction of the terminal station has been purchased, and the residue thereof will be acquired through proceedings in condemnation. The necessary consents are also being obtained from the owners of property abutting on the streets under or through which the railroad runs, and in default of such consents, the determination of commissioners appointed under the law to grant the proper authority in lieu thereof will be secured. The engineering work is now in progress and the actual construction will soon be inaugurated. It is believed that the location of the terminal station is such that it will permanently and satisfactorily accommodate the passenger traffic of your system, and it is intended that the building to be erected and the facilities to be furnished at that point shall fully correspond with the requirements of the service. It will be necessary to provide additional capital for the prosecution of this work after the expiration of the current year.

In the extraordinary expenditure for the year is included a large amount of work upon the main line and the United Railroads of New Jersey. The most important work upon the United Railroads of New Jersey was in connection with the elevation of your tracks through Newark and New Brunswick, and the revision of your line through Trenton, for the purpose of eliminating the grade crossings in those cities. The change of line at Trenton involved the construction of a new four-track stone arched bridge over the Delaware River at that point, and a corresponding change in the location of the tracks of the Philadelphia & Trenton Railroad on the western side of the river.

The other main expenditures upon that division were in the substitution of masonry and embankment for trestles on the Harsimus branch, the rebuilding of the Grand street pier at Jersey City, the prosecution of the terminal improvements at Greenville on the New York Bay Railroad, through the construction of the bulkhead, the dredging of the channel, and the filling in of the property at that point, for the accommodation of traffic to and beyond Long Island and to New York harbor; and the completion of the train shed and other facilities connected with the new passenger station at Camden, N. J., for the use of your Amboy Division and seashore lines.

Upon the main line large outlays were required in the improvement of your coal piers at Greenwich, and of piers and freight stations at other points on the Delaware River front at Philadelphia. The changes in your line at West Philadelphia, which have involved a large amount of difficult work, will be completed in the early spring. The elevated westbound passenger track, which eliminates the former grade crossing of your freight tracks and yards at Fifty-second street, is now in service, as also the undergrade crossing connecting your main tracks with the Schuylkill division. The revision between your Broad Street Terminal Station and Powelton avenue, which includes the abandonment of the passenger station at the latter point, the use of a new local and transfer station at Thirty-second and Market streets, and the substantial reconstruction of your West Philadelphia passenger yard, is being vigorously prosecuted. The tunnel connections between your New York division, the main line, and the Philadelphia, Baltimore & Washington Railroad are practically completed, as are also the two additional bridges over the Schuylkill River.

At Harrisburg the passenger station has been enlarged and improved, and the under-grade crossing at Market street completed. The new four-track stone arched bridge over the Susquehanna River, above Harrisburg, was put in service on March 30, 1902. Heavy expenditures were made on the new passenger line at Marysville and on the completion of the four-track system between Duncannon and Aqueduct, Lewistown Narrows and Mifflin, and Mount Union and Mill Creek, on the Middle Division.

At Altoona the shops were further extended, but the heaviest expenditure at that point was on the extensive gravity yard for receiving and classifying westbound trains. Heretofore the proper classification of this equipment has been prevented by the limited capacity of the present yard, and congestion has resulted whenever there was a pressure of traffic. But through the facilities which will now be furnished, not only will this tonnage be handled more promptly on your main lines, but through the making up of solid trains for Pittsburg and points beyond, its movement will be expedited upon your Western system. It is, therefore, believed that the exceptionally large outlay upon this yard is fully justified.

On the Pittsburg Division, the work on the new single-track tunnel at Gallitzin was pushed forward, the four-track system completed between Wilmore and Summerhill, and the larger portion of the work on that system finished between Latrobe and Beatty and Larimer and Stewart. The improvement of the Port Perry bridge and tunnel was also prosecuted, with the view of better accommodating the traffic to and from your Pittsburg, Virginia & Charleston Ry.

The Pittsburg station, and other facilities connected with the passenger service at that point, with the exception of a small section of the train shed, have been completed, and are now in service. The total amount of these expenditures during the year upon your main line between New York and Pittsburg, and the branches operated in connection therewith, including $7,466,185 for equipment and shop tools and machinery, was $25,874,276. Of this aggregate the sum of $8,374,276 was charged to

capital account; $5,000,000 were supplied by the fund set aside in 1901, and $12,500,000 were charged against the income of the past year. Additional expenditures upon the branch roads amounting to $5,341,630 were met by the several companies out of their own resources. On your branch and auxiliary lines the heaviest expenditure was upon the roads specially engaged in the bituminous coal and coke traffic.

On the Southwest Pennsylvania and South Fork railroads additional sections of double track were constructed to accommodate their increasing traffic, and on the Cambria and Clearfield, Tyrone and Clearfield, and Ebensburg & Black Lick Railroads branches and extensions were built and necessary additions made to the yard, siding and other facilities. On the Western Pennsylvania Railroad the outlay was mainly on double tracks and sidings and on a connection with the new stock yards on Herr's Island, near Pittsburg.

For the purpose of further developing the coal territory along the Monongahela River the Monongahela Railroad is being constructed from Brownsville Junction to the State Line between Pennsylvania and West Virginia, in the joint interests of your company and of the Pittsburg & Lake Erie Railroad, with branches up Middle and Cat's Runs, and also up Brown's Run to a connection with the Southwest Pennsylvania Ry. and the Masontown & New Salem Railroad. The construction of this line will be completed in the early summer. But the main expenditure in the Monongahela Valley was on the Pittsburg, Virginia & Charleston, where the demands of the traffic necessitated the most liberal expenditure in the acquisition of additional real estate and right of way, and in the construction of four tracks and largely increased terminals on the south side of Pittsburg. Through this work and the revision of line and construction of additional tracks at that point by your Southwestern line, the Pittsburg, Cincinnati, Chicago & St. Louis, and the improved approaches to the bridge over the Ohio River, which forms a connecting link between your Northwestern and Southwestern systems, a large portion of the heavy coal, coke and other traffic passing between your main line and branches and your system West of Pittsburg is now carried around that city on easy gradients and under much more favorable conditions for its prompt movement.

The Philadelphia, Wilmington & Baltimore and Potomac companies were on Nov. 1, 1902, merged and consolidated into the Philadelphia, Baltimore & Washington Railroad Company, thus placing under one ownership the line between Philadelphia and Washington. That company is now rebuilding its bridge across the Potomac River at Washington, and as soon as legislation pending in Congress takes definite shape, will proceed to the erection of a new passenger station at the National Capital, and the elimination of the grade crossings of your line in that city.

The Trenton Cut-Off Railroad and Schuylkill and Juniata Railroads were duly absorbed by your company, taking effect April 1, 1902. . . .

The charges to capital account during the year were as follows:

Cost of road		$4,781,131
Real estate		415,134
Equipment—		
Locomotives	$2,713,012	
Car Trust equipment	465,000	
		3,178,012
		$8,374,276
Cost of Schuylkill & Juniata R. R. absorbed		16,496,546
Cost of Trenton cut-off, absorbed		61,043
Total charges to capital account		$24,931,865

The contract with the Western Union Telegraph Co. under which the use of a portion of your right of way was grafted to it for its telegraph lines having terminated, a contract was entered into between your company and the Postal Telegraph Cable Co., on July 1, 1902, for the term of 15 years, under which a larger compensation and more advantageous terms are assured to your system for the privileges granted.

The remarkable development of business throughout the country, and particularly in the sections served by your lines, created during the past year a demand for transportation which could not be supplied. For although the traffic carried over the roads composing your system east and west of Pittsburg aggregated nearly 270,000,000 tons, being an increase of 26,000,000 tons, or more than 10 per cent. over the previous year, the necessities of the industries dependent upon your lines demanded a much larger movement. The inability to accommodate these industries was due mainly to lack of track and yard facilities. There were cars and locomotives enough to have moved a much larger traffic and possibly to have provided the transportation required if the movement had been free, but owing to the overcrowding of the running tracks and yards, it was impossible to use the equipment to its full capacity. It has been the policy of your management for years past to continuously increase these facilities so as to keep them up to the demands of the traffic; but although heavier expenditures have been made for this purpose since the beginning of the present period of business activity than ever before in the same time, the exceptional growth of the tonnage has outstripped the facilities that it was practicable to create.

The duty which your company owes to the public, as well as to the shareholders, clearly requires that your lines should be put in a condition to supply the legitimate demands of your shippers. To do this, on a scale justified by past experience, will involve a large outlay, for it is clear that on some of your lines the limit of the capacity of the running tracks and yards has been reached. This is particularly true of your main line between Pittsburg and Philadelphia, where the traffic has become exceptionally dense. The ton mileage of the main line, excluding branches, amounted to over 8,509 millions of ton-miles, and the density to 23,764,530 ton-miles for each mile of road. The earnings from freight traffic alone were $116,478.96 per mile, and the total earnings $149,128 per mile.

After careful consideration, your management has decided upon the following improvements as absolutely necessary to promptly and economically handle the present volume of traffic, and meet the demands of the next few years of active growth. These are:

First.—The building of a new connection, known as the Brilliant Branch, between the main line at East Liberty and the Allegheny Valley Ry. at Brilliant and the Western Pennsylvania Railroad at Aspinwall, and the construction of a steel viaduct between the tracks of the Port Perry Branch and the main line at Brinton. These improvements will facilitate the interchange of traffic between the Pittsburgh, Virginia & Charleston Ry., the main line, the Allegheny Valley and Western Pennsylvania Railroads, and will complete the final links in a belt line around Pittsburg. The passenger trains of the Allegheny Valley and Western Pennsylvania Railroads will be run into Pittsburg station by way of the Brilliant line, thus leaving the tracks of both roads west of their junction with that line exclusively for the movement of freight. Two large freight yards will be built respectively at the junction of this line with the Allegheny Valley Ry., and at Sharpsburg, the latter for interchange of traffic between the Western Pennsylvania Railroad and the Pittsburgh, Fort Wayne & Chicago Ry., and to serve the local industries in Allegheny City. Another yard will be built on the site of the old stock yards at East Liberty for the classification and distribution of the Pittsburg local freight. The Western Pennsylvania Railroad will be four-tracked west of the junction of the Brilliant line and will be elevated through Allegheny City to a connection with the Pittsburgh, Fort Wayne & Chicago Railway. An elevated double-track railroad will be built from the main line in Pittsburg, along Duquesne Way, to connect with a freight station to be erected upon property already secured for that purpose west of Third street. This line will also afford a connection with the present Duquesne Station at the Point, and will permit of the removal of the tracks now at grade on Liberty street, Pittsburg. Large extensions will be made to the yard at Shire Oaks on the Pittsburgh, Virginia & Charleston Railway, and to the Ormsby yard in South Pittsburg, and a new yard will be built at Thomson to serve the adjacent steel works. These improvements will add greatly to the facilities in the Pittsburg district and will, it is hoped, relieve the chronic state of congestion which has existed there for the past two years.

Second.—The double-tracking of the Western Pennsylvania Railroad and the reduction of its grades eastbound to 15.8 ft. per mile.

Third.—The building of a new low-grade four-track line from Radebaugh tunnel, near Greensburg, on the Pittsburg Division, to Millwood, east of Derry, a distance of 19 miles, and the completion of the four-track system on that division.

Fourth.—The construction of a double-track railroad, via the roadbed of the New Portage Road, between the east end of the Gallitzin tunnel and Hollidaysburg, a distance of 17 miles, and the double-tracking of the Petersburg Branch, thus furnishing an alternate line about 50 miles in length between the summit of the Allegheny Mountain and Petersburg in the Juniata Valley.

Fifth.—The building of a large classification yard at Hollidaysburg, and another at Fairview on the Northern Central Railway, on the opposite side of the Susquehanna River from Harrisburg. Experience having shown that yards may become too large for the prompt and economical movement of traffic, these new yards will be used for coal, coke, and limestone, and through the relief thus afforded, the Altoona and Harrisburg yards will be amply sufficient for the general merchandise traffic.

Sixth.—The building in connection with the four-tracking of the Northern Central Railway between the new Fairview yard and York Haven, of a new double-track low grade railroad about 95 miles in length from the latter point, via Columbia, to Philadelphia. This line will cross the Susquehanna River by a stone arched bridge near Shocks', will utilize five miles of your Columbia and Port Deposit Railroad from Columbia to Cresswell, where the new line leaves the Susquehanna to enter the valley of the Pequea, will run thence to your main line at Parkesburg, which it will follow from Parkesburg to Thorndale, and parallel it from Thorndale to Paoli, while the main line between Paoli and Philadelphia will be six-tracked.

Seventh.—The construction of a double-track elevated freight railroad through the West Philadelphia yards between the main line at 36th street and the Delaware Extension and the Philadelphia, Baltimore & Washington. In this way coal trains will be run through between Fairview and Greenwich, on the Delaware River, and traffic between the Philadelphia, Baltimore & Washington, and the New York Division may be handled directly between the Shellpot yard, north of Wilmington, and Harsimus yard on the Hudson River, without detention at West Philadelphia.

The grades on the Trenton cut-off between Glen Loch and Morrisville will be reduced from 29 to 15$^{8}/_{10}$ ft. per mile, the New York Division between Trenton and Newark will be six-tracked and the grades reduced to the same maximum, and the line through Frankford, Bristol, and Rahway straightened and elevated. A receiving and classification yard will also be built west of Frankford Junction, Philadelphia, to admit of solid trains for that section being made up at Harrisburg and run without stop through the West Philadelphia yard.

When these improvements shall have been completed, the maximum grade against the eastbound traffic, between Pittsburg and Jersey City by way of the Western Pennsylvania Railroad, will be reduced to 15.8 ft. per mile, with the exception of the western slope of the Allegheny Mountains between Conemaugh and Gallitzin, a distance of 24 miles, where the grade is 52.8 ft. per mile, and where the use of helping engines will have to be continued. On the main line between Radebaugh and Derry the opposing grade eastbound will also have been reduced from 52.8 to 15.8 ft. per mile, so that it will be necessary on that end of the Pittsburg Division to use assisting power only as far as Radebaugh.

The estimated cost of the improvements East of Pittsburg for which your company will have to provide the means, and which will require from two to three years to complete, is as follows:

For the Brilliant Branch, the Sharpsburg, Brilliant, Shire Oaks, Ormsby and other yards, the connection between the Port Perry Branch and the main line at Brinton, the elevation of the Western Pennsylvania Railroad, the extension of the elevated railroad along Duquesne Way, and the cost of the new freight station at the Point, etc.	$9,500,000
For the new line between Radebaugh and Derry, and the completion of the four-track system on the Pittsburgh Division	13,000,000
For the double-tracking of the Western Pennsylvania Railroad and other improvements thereon	2,000,000
For the new line on the New Portage roadbed, double-tracking the Petersburg Branch, and the Hollidaysburg yard	5,000,000
For completing the four-track system on the Middle Division and other improvements on that division	3,000,000
For the new line between York Haven and Parkesburg, and Thorndale and Paoli, and two additional tracks between Paoli and Philadelphia	18,000,000
For the extension of the West Philadelphia yard, the elevated railroad connecting the Maryland Division and the Delaware Extension with the main line and the New York Division, and for other facilities in West Philadelphia	3,000,000
For reducing the grades on the Trenton Cut-Off	1,500,000
For two additional tracks, making six running tracks in all, between Trenton and Newark, changes of line at Frankford and Bristol, elevating the road through Rahway, completing the elevation at Newark and New Brunswick and the change of line at Trenton, and other improvements on the New York Division	12,000,000
Total	$67,000,000

While this is a large sum, no less an expenditure will enable your company to perform its duty to the public. Your board are satisfied that the investment of this amount will result in largely increased net earnings to your property, not only from the greater volume of traffic which will be handled, but through the economies which will result from the reduction of grades, the better location and arrangement of yards, and the saving in shifting service, now unduly expensive, and in overtime to train crews, which, owing to the overcrowding of yards and tracks, has become a serious item. While the amount of such savings cannot be estimated with positive accuracy, it is safe to say that in the handling of last year's tonnage upon the lines east of Pittsburg they would have amounted to several millions of dollars.

Extensive improvements will also be required on your leased lines west of Pittsburg, a part of the funds for which will have to be supplied by your company. In addition to double-tracking material portions of the existing roads, it is proposed to proceed at once with the construction of a new line about 60 miles in length between a point on the Fort Wayne Road near Enon and Red Bank, Pa., where it will connect with the Allegheny Valley. This road will form, with the low grade division of the Allegheny Valley, the Philadelphia & Erie Railroad and the Northern Central Railway, a low grade line from the west to Harrisburg, only 28 miles longer than the present line via Pittsburg. Over this route the through traffic of the Pittsburgh, Fort Wayne & Chicago and Cleveland & Pittsburgh roads can be moved without passing through Pittsburg, and additional relief thus afforded to the congested tracks in that district. For such portion of the capital expenditure west of Pittsburg as you may supply to the Pennsylvania Company, you will be reimbursed through its dividend-paying stock or other securities.

In addition to the above expenditures, and to those required for equipment and for the work upon the tunnel line into New York, large outlays will be required upon the Philadelphia, Baltimore & Washington, the Northern Central Ry. and the Pittsburgh, Virginia & Charleston, the means for which will be provided by those companies.

In this connection it may be well to call attention to the fact that the charges to capital account for the construction of tracks and roadbed in recent years have been comparatively small. From 1897 to 1902 inclusive, a period of five years, the increase in cost of road has been only about $6,000,000, or a little over 11 per cent., for improvements of the character referred to, they hav-

ing been substantially paid for out of income, while the tonnage of the main line and branches has increased during the same time from about 47,000,000 to over 77,000,000 tons, or about 64 per cent., and while its gross earnings for the same period have increased from about $38,000,000 to $68,000,000, or nearly 80 per cent., and its net earnings from about $14,000,000 to $25,000,000, or over 78 per cent.

It will, as already stated, require from two to three years to complete these improvements, but the money needed should be provided in advance. It was in view of this fact that your board gave the necessary notice of its intention to recommend at the coming annual meeting an increase in the authorized capital. As the law of Pennsylvania requires a vote of the majority of the outstanding stock to increase either capital stock or indebtedness, and as there is always difficulty in securing such a representation, owing to your stock being held by about 29,000 persons residing in this country and abroad, your approval will be asked of an increase in the authorized stock to an amount sufficient to provide for the probable wants of the company for some years to come; but the board of directors only propose to issue at this time the amount needed to provide for the improvements hereinbefore referred to; and no further issues will be made except for such purposes as you shall approve. It is not the intention of your board to ask you to now authorize any issue of permanent bonded debt.

In the annual report for the year 1899 reference was made to the acquisition of interests in other railroads and to the good results which it was hoped to attain thereby, and your board is now gratified to be able to state that their expectations in this respect have been more than realized. It is confidently believed that the results achieved, and the fact that it has been proven to be possible to carry on the business of the railroads under a strict adherence to tariff rates, as well as the determination shown by the Government authorities and the Courts to enforce the law (in which effort they will have the active assistance of all conservatively managed railroads), will prevent a return to old methods. The doing away with unjust discriminations and preferences between shippers, and the placing thereby of the transportation business of the country upon a stable basis, cannot fail to bring about better relations between the public and the railroad companies, and must also add largely to the value of the railroad investments and to the security of the business interests which are dependent upon railway transportation. Your management having accomplished what it sought to attain by the policy referred to, and having completed the investments then contemplated, it is believed that further acquisitions of this character will be unnecessary. . . .

TECHNICAL.

Manufacturing and Business.

The Positive Railway Sander Co. has been incorporated in New Jersey, with $50,000 capital.

The T. H. Symington Co., Wilmington, Del., has been incorporated under the laws of Delaware.

The Anti-Telescoping Railway Train Guard Company has been incorporated under the laws of New Jersey.

The Youngstown Car Mfg. Co., Youngstown, Ohio, will make mining supplies in addition to repairing standard freight cars, as at present.

J. T. Schlacks, for some time with Fitz-Hugh & Co. in Chicago, has been appointed to represent the company in New York City, succeeding Henry J. Davis, resigned.

C. C. Murray will be connected with the Railway Appliances Company, with headquarters at Pittsburg, giving his time more particularly to the sale of the Q and C pneumatic tools.

The concession granted Isaac M. Hutchison, of Mexico City, to establish a car factory in Mexico, will allow the free importation of all materials to be used in and about the cars and shops.

The business of the Massillon Bridge Co., Massillon, Ohio, has increased so much of late that an enlargement of the plant is necessary, and the company is considering the question of removing to some other city.

The Allis-Chalmers Company will on May 1 remove its general office from the present location in the Home Insurance Bldg., to the New York Life Bldg., corner of Monroe and La Salle streets, Chicago.

Pawling & Harnischfeger, Milwaukee, Wis., makers of electric traveling cranes, report the sale of 55 cranes between Jan. 1. and Feb. 25. Of these, the Ingersoll-Sergeant Drill Co., Phillipsburg, N. J., ordered 14.

The G. M. Scofield Company, of Pittsburg, Pa., is understood to be the lowest bidder for the contract of finishing the dry dock at League Island, this company agreeing to complete the dock in two years for $1,143,000.

John F. Harrigan has been elected President of the National-Fulton Brass Mfg. Co., of Detroit, Mich., which operates the shops of the Fulton Iron & Engine Works at Detroit, and the National Brass Mfg. Co. at St. Louis, Mo.

The Pittsburg Filter Mfg. Co. has opened an office at 29 Broadway, New York City, which will be in charge of R. Dorn. Mr. Dorn was formerly with the Industrial Water Co. of this city, and is familiar with the subject of water purification.

G. Fred Collins has resigned his position with B. M. Jones & Co., and is succeeded in the eastern department by Richard L. Thomas, long and favorably known in the railroad supply trade. Mr. Thomas will still continue to act for the National Lock Washer Co.

F. F. Wetmore, County Surveyor of Oceana County, Mich., with office at Pentwater, writes that he would like to get catalogues from manufacturers and dealers in new and second-hand dredgers suitable for drainage work; also for hoisting engines and machinery.

The Laconia Car Co., Laconia, N. H., has found it necessary to make an addition to its malleable iron foundry. The increased capacity will be about 25 per cent., and at present the company has enough orders to keep the foundry running to its full capacity for several months.

The E. J. Ward Company have turned over to the Railway Appliances Company their car vestibule diaphragm business and have withdrawn themselves entirely from that department of railroad supplies. The Railway Appliances Company have purchased their entire stock of diaphragms, material and machinery, and removed the manufacture to Chicago Heights.

The Northern Engineering Works, Detroit, Mich., has recently installed electric cranes for the following concerns: C. D. Jackson & Co., 25 ton crane; Detroit Ship Building Co., five cranes, five to 40 tons; Allis-Chalmers Co., Milwaukee, 12 cranes; American Ship Building Co., three cranes; also for P. A. Clum & Co., C. & G. Cooper Co., and the Macbeth Iron Co.

The Northern Metallic Packing Co. has been incorporated at St. Paul, Minn., with a capital of $50,000 to do a general manufacturing business. Railroad specialties are to be made, principal among which will be Northern metallic packing, Curran locomotive chime whistle and Fuhrman pneumatic motor. The officers are Alfred Munch, President; S. B. Mack, Vice-President; S. R. Parslow, Treasurer; D. E. Anderson, Secretary.

The Baltimore Railway Specialty Co. has been organized to take over the going business of the Baltimore Ball Bearing Co. The latter company was organized by J. E. Norwood to make patent ball bearing center and side plates. The new company is capitalized at $900,000. Thomas H. Symington is President; J. W. Middendorf, Vice-President; W. Eason Williams, Secretary and Treasurer, and J. E. Norwood, Mechanical Engineer.

The Otis Elevator Co. has been awarded the John Scott Legacy Medal and Premium by the Franklin Institute for its electric elevator for private residences, which dispenses with the services of an attendant and is operated by merely pushing buttons at the various landings and in the car. The Committee on Science and the Arts, which recommended the award, made a thorough inspection of several existing installations.

The New York Edison Co. has ordered from Westinghouse, Church, Kerr & Co., a 6,500 h.p. Westinghouse vertical three-cylinder compound engine of the same size and design as the eight already in operation and now being installed at the 39th Street Water Side Station. The New York Central has also ordered four Westinghouse-Corliss engines of the horizontal, cross-compound type from the same concern, to form the main equipment of a new power station at Weehawken, N. J.

The Chicago Pneumatic Tool Company completed last week installations of pneumatic machinery for Moran Brothers Company, Seattle, Wash.; Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.; International & Great Northern R. R., Palestine, Texas; American Car & Foundry Co., Detroit, Mich.; Stacey Manufacturing Co., Cincinnati, Ohio; Canadian Bridge Co., Walkerville, Ont.; Standard Oil Co., Brooklyn, N. Y.; Lehigh Valley R. R., Buffalo, N. Y.; American Shipbuilding Co., Cleveland, Ohio; Brooklyn Heights Ry. Co., Brooklyn, N. Y.; Wm. Wharton, Jr., & Co., Inc., Philadelphia, Pa.

Iron and Steel.

E. E. Slick has been made Chief Engineer of the New Castle district plants of the National Steel Co.

John Philbrick Laflin, Vice-President of the East Chicago Foundry Co., died in Chicago last week at the age of 46.

The American Bridge Co. is said to have an option for 30 days on the property of the Virginia Bridge & Iron Co., Roanoke, Va.

The Whole Creek Iron Works, Brooklyn, N. Y., has been incorporated by H. H. Hull and W. I. Lee, of Brooklyn, and Banton Moore, of New York.

The Jennet Bridge & Iron Works, Chicago, Ill., has been incorporated with $10,000 capital. Peter Jennet, M. F. Carr and Jesse Baldwin are incorporators.

The Hudson River Foundry Co., Poughkeepsie, N. Y., has been incorporated with $30,000 capital by P. H. Troy, Geo. Sayne and J. J. Thompson, of Poughkeepsie.

The Lee Engineering Co., New York City, has been incorporated with $50,000 capital, by Horace Lee, New York City; J. C. Mulford, Newark, N. J., and H. A. Moses, Paterson, N. J.

Benjamin Barrios, the attorney for the Rio Seco Ry., Mexico, is interested in the San Isidor Iron Mines Co., Lower California, which has recently been formed with $200,000 capital, Mexican currency.

According to the report of the Empire Steel & Iron Co. for the year ending Dec. 31, 1902, the net earnings of the company were $203,087; the sum of $46,575 was charged to depreciation and $170,147 to improvements.

The contract for supplying the 8,200 tons of 80-lb. rails for the Temiskaming & Northern (Ontario Government) Railway has been let to Charles Cammell & Co., of Sheffield, Eng. The price is said to be $28.85 f.o.b., at North Bay.

The Oregon R. R. & Navigation Co. has recently let contracts for 10 new steel bridges, to cost about $100,000. The most important one is that over the Spokane River at Spokane. It will be 520 ft. long, divided into three spans.

Advance in Iron Ore Prices.

The expected advance in the price of Lake ores has come, base prices having been determined upon as follows: Mesaba Bessemer, $4 per ton, lower lake ports, as compared with $3.25 last season; Mesaba non-Bessemer, $3.20, with a differential on certain classes; Old Range Bessemers, $4.50, as compared with $4.25 last year, and Old Range Non-Bessemer Ores, $3.60, as compared with $3.25. It is estimated that out of a total production for 1903 there are available for sale 10,700,000 tons. With the advances in coke and coal, wages, and freights, the cost sheets will soon show a marked contrast with last year's figures.—*The Iron Age.*

THE SCRAP HEAP.

Notes.

The New York, Philadelphia & Norfolk has put in service at Cape Charles a new car float, built by the Harlan & Hollingsworth Co., which will carry 38 freight cars.

It is announced in Houston, Texas, that the Wells-Fargo Express Co. is to pay pensions to retiring employees who have worked for the company a long time.

The Great Northern now runs two trains daily, each way, through between St. Paul and Seattle, and the time has been made 12 hours shorter than the best time previous to March 1.

A press despatch from Pittsburg, March 2, stated that for the first time since November there was a free movement of freight over the Pittsburgh Division of the Pennsylvania Railroad; and on Tuesday it was announced that the Pennsylvania, both east and west of Pittsburg, had removed all embargoes.

The United States Supreme Court has sustained the law of Mississippi imposing a tax on sleeping cars. The court holds that the argument of the company that the tax would be an undue burden on intrastate travel is unfounded, because the company need not carry local passengers; and it is held that the tax is not a burden on interstate commerce.

Demurrage on freight cars is only one of the troubles now afflicting the New Haven road. Two hundred and fifty dollars a day is named by the newspapers as the sum which the road is paying as demurrage on ships which have brought coal to the company from Wales. It appears that the company ordered 80,000 tons of Welsh coal and that 15 steamships have arrived all in a bunch.

Judge Parlange, in the United States Circuit Court at New Orleans, has issued a permanent injunction against the State Railroad Commissioners of Louisiana forbidding the enforcement of their order reducing the rate for the transportation of cotton from Vivian to Shreveport over the Kansas City Southern Railway. The order in question reduced the rate from 75 cents a bale to 50 cents (distance 34 miles). The court holds that 50 cents is an unreasonable rate.

Leading members of the New York Produce Exchange announce to the world that they are going to establish a freight bureau, so as to provide a more efficient means of securing their rights from the railroads. They say that they have been "jollied" long enough, and that they are now going to imitate the wise example of St. Louis, Memphis, Cincinnati, Kansas City and other business communities which have maintained bureaus for years past. It is proposed not only to have a commissioner, who shall be fully acquainted with all the tricks of the railroad men, but eminent legal talent also.

Syracuse papers report that the New York Central has granted an increase of 5 per cent. in wages to enginemen, both freight and passenger. The New York, Chicago & St. Louis has made an increase of about 5 per cent. in the pay of conductors and brakemen. The Atchison, Topeka & Santa Fe, according to reports from Topeka, has increased the pay of trainmen by 12 per cent. for passenger men and 15 for freight, as has been done by other roads in the southwest. A similar report is published concerning the Wabash Lines west of the Mississippi River. Other roads on which increases are reported are the Chicago, St. Paul, Minneapolis & Omaha, the Boston & Maine and the Alabama Great Southern.

A committee of the Trunk Line Association consisting of the Passenger Traffic Managers of the Pennsylvania, the Lehigh Valley, the Delaware, Lackawanna & Western, the Erie, the Baltimore & Ohio, and the Chesapeake & Ohio, on Feb. 25 agreed to issue interchangeable mileage tickets. These tickets (books) will contain 1,000 miles, and will be sold for $30, with a rebate of $10. During the enforcement of the New York State law, declared unconstitutional about a year ago, which required a flat rate of 2 cents a mile on mileage books, it was obviously impossible to arrange interchangeable mileage and at the same time prevent scalping. Now, however, there seems to be no obstacle to the successful adoption of a rebate ticket.

The Sundry Civil Appropriation Bill.

As passed by the U. S. Senate on Feb. 26, the Sundry Civil appropriation bill carries a total appropriation of

$83,279,650, or $3,429,701 more than appropriated by the lower House. The office building for the House was agreed to by the Senate and the Superintendent of the Capitol is directed to prepare a general plan for a similar building for the use of the Senate, to be located northeast of and near the Capitol, and to report to Congress Dec. 7, 1903. The provision in the bill as passed by the House for extending the central portion of the Capitol building proper on the east front was struck out in the Senate.

A Union Station for Washington, D. C.

The bill providing for a Union railroad station for Washington was finally passed on Feb. 25 by a vote of 157 to 98, by which the House of Representatives receded from its amendment cutting down from $1,500,000 to $1,000,000 the amount to be paid to each of the two railroads. The Senate provision to pay the Pennsylvania and Baltimore & Ohio Railroads $1,500,000 each was allowed to stand after many conferences between the two Houses of Congress, the danger of the failure of the bill becoming great as the session nears its close. The bill provides for the elevation of the tracks within the city, abolishes grade crossings and provides for a very large Union station to be monumental in character and to be located on Massachusetts avenue, not far from the present Baltimore & Ohio station, and to be reached from the south by a tunnel under Capitol Hill. It is understood that much of the land necessary for the new terminals has already been secured. Some details of this bill will be found in the *Railroad Gazette* for April 11, 1902, page 262, and Dec. 12, 1902, page 451.

The Peekskill Landslide.

During the past five years the New York Central has been moving the roadbed back from the Hudson River at all doubtful places, and extensive work has been done at several places south of Garrison, north of Poughkeepsie and also along the west shore, on the opposite side of the river, involving the construction of two tunnels, many thousand yards of rock excavation and the placing along the river from New York to Albany of over 500,000 cubic yards of riprap. North of Peekskill the foundation, on an inclined rock stratum, caused apprehension more than a year ago, and the Chief Engineer began a heavy rock-cutting and tunnel in order to get back from the river and be quite safe. On Feb. 28 about 60 feet of the main track at a point two miles north of Peekskill slid into the river. The movement was anticipated, and the new work was so nearly completed that trains were interrupted only 6½ hours. The track was quickly thrown to its permanent location.

Increased Estimate for Erie Canal.

State Engineer Edward A. Bond has submitted to the New York Legislature a revisal of his previous estimate for the enlargement of the Erie Canal, adding approximately $18,000,000 to the original figure of $82,000,000. The increase is to cover increased cost of labor, riparian damages, fees for a special commission of expert engineers, right of way, allowance for erroneous estimate and other items, including certain dams required for the "canalizing" of the Mohawk and Seneca rivers, and about seven million for the Champlain Canal.

LOCOMOTIVE BUILDING.

The Buffalo, Rochester & Pittsburgh is having five locomotives built at the Baldwin Works.

The Cleveland, Cincinnati, Chicago & St. Louis is having 12 locomotives built at the Brooks Works.

The Indianapolis Union is having four locomotives built at the Schenectady Works of the American Locomotive Co.

The Chicago & Western Indiana is having 18 locomotives built by the American Locomotive Co. at the Cooke Works.

F. M. Hicks, of the Hicks Locomotive & Car Works, has an order to build one six-wheel switching locomotive for the Rodgers-Allison Lumber Co., Vanderbilt, Mich.

CAR BUILDING.

The Chesapeake & Ohio is having 10 coaches built by the Pullman Co.

The American Car & Foundry Co. has orders for 39 miscellaneous cars.

The Green Bay & Western is having 100 freights built by Haskell & Barker.

The Muncie & Western is having 100 freights built at the Laconia Car Works.

The Toledo, Peoria & Western is having 200 freights built by the Pullman Co.

The Delaware & Hudson has ordered 300 mine cars from the American Car & Foundry Co.

The Rodger Ballast Car Co. has ordered 150 ballast cars from the American Car & Foundry Co.

The Standard Supply & Equipment Co. has ordered 300 dump cars from the American Car & Foundry Co.

The Raritan River R. R. Co. has ordered six low-side gondola cars, 80,000 lbs. capacity, from the Pressed Steel Car Co.

The Pere Marquette has ordered 1,750 box, 250 stock and 1,000 coal cars, all of 60,000 lbs. capacity, from the American Car & Foundry Co.

The Missouri Pacific has ordered 50 coaches, 35 chair, 10 baggage and five combination mail and baggage cars from the American Car & Foundry Co.

The Etna & Vesuvius Coal Co. is having 16 flat bottom gondola cars, with twin hoppers, 80,000 lbs. capacity, built at the works of the Pressed Steel Car Co.

Thebaud Bros. (New York) have placed an order with the American Car & Foundry Co. for 60 flat, 20 gondola, 100 box, six caboose and seven passenger cars. These are to be used on the narrow gage division of the Ferrocarriles Unidos de Yucatan.

The Nashville, Chattanooga & St. Louis intends building 250 drop bottom gondola cars of 80,000 lbs. capacity. The cars will be 36 ft. 3½ in. long, 9 ft. 4 in. wide and 4 ft. ½ in. high, all inside measurements, to be built of wood, with wooden underframes. The special equipment will include: Simplex brake-beams, Westinghouse air-brakes, M. C. B. standard brasses, Tower couplers, Miner tandem draft rigging, N. C. & St. L. standard paint and M. C. B. arch bar trucks.

The Kingan Refrigerator Line, as reported in our issue of Feb. 20, has ordered 50 refrigerator cars of 60,000 lbs. capacity from the American Car & Foundry Co., for May delivery. The cars will be 36 ft. long, 8 ft. 11 in. wide, over side sills, and 7 ft. 2½ in. high, between sill and plate, to be built of wood, with wooden and metal underframes. The special equipment includes: Common Sense bolsters, Westinghouse air-brakes, Janney couplers and Gould draft rigging.

F. M. Hicks, of the Hicks Locomotive & Car Works, has orders to build one private car for the Virginia & Southwestern; two combination passenger and baggage cars for the Georgia & Northern; three flat cars for the Central Arizona. They also have orders to rebuild one 66-ft. combination car for the Cuba Rolling Stock Co.; one combination passenger and baggage coach for the Boca & Loyalton, and one passenger coach for the Georgia, Florida & Alabama. This last order was incorrectly stated in our issue of Feb. 27.

The Atchison, Topeka & Santa Fe, as reported in our issue of Feb. 6, has ordered 1,500 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., for July and August delivery, and 1,200 box cars of 60,000 lbs. capacity from the Standard Steel Car Co. The cars will weigh 35,000 lbs. and will be 36 ft. long and 8 ft. high, inside measurement, to be built of wood metal posts with wooden underframes. The special equipment will include M. C. B. axles, cast-steel bolsters, M. C. B. brake-shoes, Westinghouse brakes, M. C. B. brasses, Trojan M. C. B. couplers, Security doors, Miner draft rigging, McCord journal boxes and journal box lids, Murphy outside roofs and cast-steel trucks.

The Chicago Junction, as reported in our issue of Feb. 27, has ordered 66 box cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Co. The cars will weigh 30,000 lbs., and measure 37 ft. 7¾ in. long, over end sills; 8 ft. 9 in. wide, over side sills, and 6 ft. 11¼ in. high, from floor to carline. The special equipment includes: M. C. B. axles, Western Steel Car & Foundry Co.'s structural steel bolsters, M. C. B. brake-shoes, Westinghouse air-brakes, M. C. B. standard brasses, Buckeye couplers, M. C. B. standard draft rigging, McCord journal boxes and lids, Detroit mineral paint, C. B. Hutchins & Sons' roofs, Western Steel Car & Foundry Co.'s standard trucks and Griffin wheels.

The Texas & Pacific is building a number of flat cars of 60,000 lbs. capacity at its Marshall (Texas) shops. The cars will weigh 24,000 lbs., and measure 34 ft. long and 9 ft. wide, to be built of wood, with metal underframes. The special equipment includes: Block-Pollak Iron Co.'s axles, American Steel Foundries' bolsters, Damascus brake-beams, Westinghouse air-brakes, J. W. Garratt Brass Foundry Co.'s brasses, Tower couplers, "Saling" draft rigging, Fletcher journal box lids, Patterson-Sargent paint, A. French Spring Co.'s springs and American Steel Foundries' trucks. This road will also shortly commence the construction of some stock cars, specifications for which have not yet been decided.

The Cleveland, Cincinnati, Chicago & St. Louis, as reported in our issue of Feb. 6, has ordered 1,000 coal cars of 80,000 lbs. capacity, from the American Car & Foundry Co. The cars will weigh 34,000 lbs., and will be 36 ft. long, 9 ft. wide and 48 in. high, inside measurement, to be built of wood, with wooden underframes. The special equipment includes steel axles, Simplex bolsters, National hollow brake-beams, Congdon brake-shoes, Westinghouse brakes, M. C. B. couplers, with Cleveland, Cincinnati, Chicago & St. Louis standard draft rigging. This company is also building at its own shops 300 flat cars of 80,000 lbs. capacity, which will be 40 ft. long, 9 ft. wide, to be built of wood with wooden underframes. The special equipment will include steel axles, Simplex bolsters, National hollow brake-beams, Westinghouse brakes, Janney couplers and Hennessy friction draft rigging.

BRIDGE BUILDING.

Amherstburg, Ont.—The Lake Erie & Detroit River Ry. proposes to put a bridge over Niagara River on a proposed extension.

Benwood, W. Va.—Bids are wanted March 31 by the Bellaire, Benwood & Wheeling Bridge Co. for building a steel bridge over the Ohio River between Benwood and Bellaire. Address James H. McCrady, President, 301 Sixth street, Braddock, Pa.

Buffalo, N. Y.—The Lake Shore & Michigan Southern and the Erie Railroads and the Grade Crossing Commission have reached a decision in the matter of abolishing the grade crossings in Perry street, by building viaducts. The work will cost in the neighborhood of $150,000, and reports state that contracts may be let this summer. Edward B. Guthrie, Chief Engineer to the Commission.

Burlington, N. J.—A bill has been introduced in the State Legislature authorizing a bridge over the Delaware River between Burlington and Bristol.

Byron, N. Y.—The New York Central & Hudson River will receive bids until March 9 for the manufacture and delivery of the superstructure for the elimination of the grade crossing at Main street in Byron.

Crystal Falls, Mich.—The Chicago & North Western, according to report, will build a steel bridge in this city at a cost of about $30,000.

Decatur, Ind.—Bids are wanted March 9, by the County Commissioners, for building a steel bridge.

Delaware, Ohio.—Bids are wanted until March 9 for building a three-span deck plate girder bridge across Big Walnut Creek. Frank Warren, County Auditor.

Detroit, Mich.—Local reports state that the Pere Marquette International Bridge Co. is being organized to build a bridge over the Detroit River in the neighborhood of Grosse Isle, about 20 miles below Detroit. F. W. Stevens, General Counsel for the Pere Marquette Ry., is interested.

East Liverpool, Ohio.—A bridge will be built over the Panhandle tracks at First street.

Elizabeth, N. J.—Bids are wanted March 19, by the Board of Chosen Freeholders, for a concrete steel arch bridge over Elizabeth River at Irvington avenue. J. L. Bauer, County Engineer.

Flushing, N. Y.—The old Flushing bridge between Bridge street and Jackson avenue will be rebuilt. It is said plans are with Edward M. Byrnes, Assistant Engineer, Borough of Queens. Estimate, $270,000. Contract may be let in July.

Granbury, Texas.—Hood County has decided to issue bonds and build a bridge over Brazos River at a cost of $12,500. Contracts not let. K. H. Faulkner can give information.

Hanover, Mass.—A viaduct in this place is proposed at a cost of $12,000. Address the County Commissioners at Plymouth, Mass.

Havre de Grace, Md.—In regard to the persistent reports that the Philadelphia, Baltimore & Washington will build a new bridge over the Susquehanna at Havre de Grace, Mr. Brown, Chief Engineer, says that while the company may some time replace the present single track structure, no decision has been made in the matter, and probably none will be until the work of elevating the tracks at Wilmington and Chester has been completed.

Hoboken, N. J.—A viaduct is proposed from the foot of Bowers street, Jersey City Heights, to Hoboken.

Huntsville, Tenn.—Congress has passed a bill authorizing a railroad and highway bridge over the Tennessee River near Hobb's Island. The Louisville & Nashville is said to be interested.

Jacksonville, Fla.—The kind of viaduct to be built on Bridge street over the railroad tracks has been decided. Edwin Thacher, of New York, has made preliminary plans for a combination concrete and steel arch bridge, the total length of which will be 243 ft., and about 58 ft. wide. W. H. Pleasants, of the Atlantic Coast Line, may be addressed.

Kansas City, Mo.—Local reports state that there is a probability of letting a contract pretty soon for the Tenth street viaduct. Address the Metropolitan Street Ry.

Luray, Va.—There is a bill in the State Legislature authorizing Page County to issue bonds to build a bridge over Shenandoah River.

Missoula, Mont.—A bridge to consist of two 100-ft. spans is proposed over Missoula River from Van Buren avenue to John street. The approaches will be 100 ft. each.

Marshall, Texas.—Geo. T. Walker, Purchasing Agent, Texas Southern Ry., will want bids May 1 for building an iron bridge 150 ft. long.

Monticello, Ill.—Bids are wanted March 9 for a 90-ft. steel highway bridge on stone masonry. Ira O. Baker, Champaign, Ill.

Nashville, Tenn.—Bids will be received by the committee of which R. D. Marshall is a member, until March 16, for a steel bridge at Lickton.

New Glasgow, N. S.—The Egerton Tramway Co. proposes to replace the bridge over the river with a heavy steel one. N. H. Flaherty, New Glasgow, N. S., represents the company.

New York, N. Y.—The Erie R. R., according to report, will build a steel footbridge over West street as an approach to its ferry terminal.

Olathe, Kan.—Bids are wanted March 16 for building six bridges at a total cost of $10,000. J. T. Cramer, Chairman, County Commissioners.

Ottawa, Ont.—The Canadian Pacific Ry. is considering adding another pier to the Interprovincial bridge at Ottawa, in order to make an approach from its Sussex street station.

The Carleton County Council is asking bids for the superstructure of the Marlborough Creek bridge. Tenders for a truss bridge were recently asked, but alterations have been made in the plans.

Pasadena, Cal.—The Board of Supervisors has decided to build a concrete arch bridge on Alhambra road.

Pennsylvania.—The U. S. Senate on Feb. 25 passed a bill authorizing the Donora Southern R. R. to build a bridge across the Monongahela River, in Pennsylvania.

Plainwell, Mich.—Bids are wanted March 10 for the bridge at Main street, to be steel or concrete. A. L. Nichols, Supervisor.

Pottstown, Pa.—The Warwick Iron & Steel Co. will erect a bridge over the river opposite its plant for its own use.

Ruby, Texas.—Bids are wanted March 9 for building two iron bridges. Jesse Wright, County Judge.

Scottdale, Pa.—A 60-ft. bridge will be built over Jacob Creek. O. G. Chick, Clerk, County Commissioners, Uniontown.

Seattle, Wash.—The Northern Pacific will build an overhead bridge on Valley street, in Argo. It will be a steel structure about 600 ft. long.

Three Rivers, Mich.—Bids are wanted April 1 for $30,000 of bridge and paving bonds. James R. Bunn, City Clerk.

Washington, D. C.—Sealed proposals for reconstruction of Pier No. 5 of Aqueduct Bridge across Potomac River at Georgetown, D. C., will be received at the U. S. Engineer Office, until 12 m., March 30, and then publicly opened. Information from Chas. J. Allen, Lt. Col. Engrs.

Woodsfield, Ohio.—Bids will be wanted about July 1 for three bridges in Monroe County. Address W. W. Glesenkamp, Commissioner.

Zanesville, Ohio.—The O., R & W. Ry. will need some bridges, but arrangements are not yet made. J. K. Gedder, General Manager.

Other Structures.

Atlanta, Ga.—Local reports indicate that there is early probability of getting plans out for the union station to be built in Atlanta. The Atlanta Terminal Company, recently organized, will ask competitive drawings. H. M. Steele, Chief Engineer of the Central of Georgia, has made preliminary drawings of the general lay-out for station and yards.

Baltimore, Md.—The Baltimore & Ohio contemplates enlargement of the Mount Clare shops, but definite arrangements have not been decided upon.

Camden, N. J.—The Whitney Car Wheel Co. will locate its plant between Eleventh and Twelfth streets, Chelten avenue and the Pennsylvania tracks. Bids are being asked by the architects, Milligan & Webber, of Philadelphia. Estimate, $100,000.

Cincinnati, Ohio.—Bids will be received at the office of the Commissioners of Water Works at Cincinnati until March 17, for the construction of cold storage houses, trestle approaches, inclines and tracks to the pumping station near California, Hamilton County, Ohio, and for the pumping station between Eastern avenue and the Ohio River, in Cincinnati. Plans and specifications are on file at the office of the Chief Engineer.

Cleveland, Ohio.—The Bowler Foundry Co. is having plans made by the Wellman-Seaver-Morgan Engineering Co. for shops to cost $300,000.

Council Bluffs, Iowa.—The contract for building the new Chicago Great Western freight station has been let to Wickham Bros., of Council Bluffs, at $35,000.

La Crosse, Wis.—The Chicago, Burlington & Quincy contemplates building new shops at La Crosse.

Lorain, Ohio.—President W. B. Schiller, of the National Tube Works Co., has announced that improvements costing $8,000,000 have been authorized at Lorain, and that important repairs are to be made at the Riverside Department at Benwood, and the Pennsylvania Department in Pittsburg. W. H. Latshaw, First Vice-President, has resigned and is succeeded by E. D. Worcester, General Sales Agent, who will hereafter be First Vice-President and General Manager of Sales.

Mattoon, Ill.—Plans have been made for the new station to be built by the Big Four and Illinois Central roads. Probable cost, $45,000.

MILWAUKEE, WIS.—The Piler & Stowell Co. has begun work on a new foundry, 250 x 400 ft., to cost $400,000. Gray iron and steel castings will be the principal product.

MONCTON, N. B.—Bids will be received by D. Pottinger, General Manager, Intercolonial Ry., March 18, for new freight car shops at Moncton.

MONTREAL, QUE.—The Montreal Harbor Commissioners are considering building permanent sheds at their high level wharves, and have before them estimates of $1,517,300 for wooden structures and $2,382,000 for steel buildings.

NEW CASTLE, PA.—The Pennsylvania R. R. proposes to build a large passenger station here.

NORFOLK, VA.—The R. M. Spedden Ship Building Co. of Baltimore, is negotiating for a site near Hampton Roads for a ship yard.

OTTAWA, ONT.—The Canadian Pacific is preparing plans for a new station and freight shed on Sussex street, Ottawa.

PHILADELPHIA, PA.—The contract for building the new machine shops at League Island Navy Yard for the Bureau of Steam Engineering, has been let to Snare & Triest Co., New York, at about $300,000.

PITTSBURG, PA.—The contract for building the new Wabash terminal passenger station at Liberty and Ferry streets, in Pittsburg, has been let to the Geo. A. Fuller Co. The station was described and illustrated in the *Railroad Gazette* Nov. 7, 1902. The work will cost about $1,000,000. The architect is T. C. Link, St. Louis, Mo.

Improvements costing between $4,000,000 and $5,000,000 will be made this year by the Jones & Laughlin Steel Co. Plans have been made for seven Talbot open-hearth furnaces, similar to those now in operation; also for two modern blast furnaces, to cost about $2,000,000.

PORT MORRIS, N. Y.—Bids are wanted until 3 p.m., March 9, by H. Fernstrom, Chief Engineer, New York Central, for building new crib pier, making connection with present bulkhead, and building extension thereto, removing old pier and crib work now in existence, including all necessary dredging and riprap filling, all at Port Morris.

RUSHVILLE, IND.—The Indianapolis & Cincinnati Traction Co., John W. Moore, Chief Engineer, will build a power house, probably at Rushville. It is to be 600 x 800 ft., and, with its equipment, cost about $200,000.

ST. LOUIS, MO.—The power house of the St. Louis & Suburban Electric Street line was destroyed by fire, as were also a number of cars. The loss is placed at $200,000.

ST. JOHN, N. B.—The Dominion Coal Co., Sydney, N. S., proposes remodeling the Robertson wharf at St. John, N. B., and build thereon a coal handling plant for rapid unloading of ships. C. M. Odell, Sydney, is engineer in charge of the work.

SEATTLE, WASH.—The Seattle Iron & Steel Company has been formed with a capital of $6,000,000 to build in Seattle an iron furnace with 200 tons daily capacity, a 100-ton steel plant and a rolling mill.

SPRINGFIELD, MO.—An addition will soon be built to the St. Louis & San Francisco shops. The new building will be 300 x 75 ft.

VERONA, PA.—The Pennsylvania will soon begin work on the new shops at Verona, on the Buffalo & Allegheny Valley Division.

WELLSVILLE, OHIO.—Contracts have been let by the American Sheet Steel Co. for extensive improvements at two of the plants of that company which will increase the production of polished and planished sheets. The work includes a new structural steel mill at Wellsville; also three sheet mills to be added to the Dewees Wood plant at McKeesport.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

American Street Railway Association.

The executive committee has decided to hold the annual meeting at Saratoga, N. Y., on Wednesday, Sept. 2.

Engineers' Society of Western Pennsylvania.

Some 50 members of the Engineers' Society of Western Pennsylvania have organized a structural section, which will include bridge building, concrete work, trestles, foundations and steel structures. James K. Lyons, of the American Bridge Co., was appointed temporary chairman, and Willis Whited, City Engineer, was made temporary Secretary.

The Railway Signaling Club.

The March meeting of this Club will be held at Hotel Manhattan, New York City, on Tuesday next (March 10), beginning at 2 p.m. The principal business of the meeting will be an informal discussion, to be opened by Mr. H. M. Sperry, on the problems which confront the signal engineer in connection with providing adequate block signals for fast trains. An outline of Mr. Sperry's topic was given in this column last week.

M. C. B. Association.

The Arbitration Committee of the Master Car Builders' Association has issued in pamphlet form its decisions on cases No. 644 to 650 inclusive. These decisions have to do with disputed charges for labor in removing and replacing air-brake hose; for the cost and labor of putting on an end door; for removing old wheels which became seamy in eight days, and other equally exciting subjects. In five out of the seven cases the committee sustained the bill which had been presented.

PERSONAL.

—Mr. A. C. Bird, Third Vice-President of the Chicago, Milwaukee & St. Paul, has accepted an offer from the Gould Lines, to become Traffic Director. A new office; headquarters not determined.

—Mr. Lewis B. Eveland, for 16 years Traveling Passenger Agent for the Denver & Rio Grande, died at his home in Kansas City, Mo., Feb. 22, at the age of 64. He was twice Treasurer of Kansas City.

—Mr. George R. Morse, formerly the Vice-President and Treasurer of the Iowa Central Railway, has formed with Mr. Herbert H. Knox, the New York Stock Exchange firm of Morse & Knox, with office at 18 Wall street.

—Mr. Conrad N. Jordan, Assistant Treasurer of the United States for many years, and a banker of note, died in New York City on Feb. 26. Mr. Jordan was 63 years old, and in 1880 was Treasurer of the New York, Ontario & Western.

—Mr. Henry R. Hawley, for several years Master Mechanic of the Brooklyn City Railroad, Brooklyn, N. Y., and subsequently for a long time holding a similar position with the Central Railroad of New Jersey, died in Brooklyn Feb. 28 at 59 years of age.

—Mr. William Wesley Upp, who built a number of bridges for the Government during the Civil War, and who did considerable similar work for the Pennsylvania Railroad, including all structures on the Columbia & Port Deposit road, died in Columbia, Pa., Feb. 24, at the age of 72.

—Mr. Charles J. Kittredge, 85 years old, of Hinsdale, Mass., and at one time a State Director in the Boston & Albany Railroad, died on March 1. He served several terms in the Legislature, and as one of the Committee on Railroads in the Senate in 1870 he made a minority report on the then famous Boston, Hartford & Erie matter.

—Colonel Alfred Landon Rives, who built Cabin John bridge and assisted in building the Capitol at Washington, died in Virginia on Feb. 27 at the age of 69. He attended the University of Virginia and was graduated from an engineering school in Paris. Col. Rives was Engineer on the Washington Aqueduct and later in charge of surveys in improving the Potomac River. He served as Lieut.-Colonel of Engineers in the Confederate Army and after the war was Engineer on the Chesapeake & Ohio Railroad and Chief Engineer on the South & North Alabama. He was at one time Vice-President and General Manager of the Mobile & Ohio and later of the Richmond & Danville.

—Mr. Edward F. Kearney, who has recently been appointed Superintendent, in charge of transportation of the Terminal Railroad Association of St. Louis, and the St. Louis Merchants Bridge Terminal Ry. Co., began his railroad service in the year 1882 as a telegraph operator on the Pennsylvania Lines West of Pittsburgh. He has held such positions as freight clerk, chief operator in the Superintendent's office, Train Despatcher, Trainmaster's clerk, and chief clerk to the Superintendent, until Dec. 1, 1889, when he was appointed Trainmaster at Indianapolis, on the Southwest System. He was transferred to the Logansport Division of the same system a year ago and has now resigned to accept the above named office.

—Mr. Charles Davenport, who died at the home of his son, Albert N. Davenport in East Watertown, Mass., on Feb. 14, at the age of 91, was one of the first car builders in this country. He was born in Newton Center, Mass., May 25, 1812, and was for many years the senior partner of the car building firm of Davenport & Bridges. At the firm's shops in Cambridge some of the first cars for early street railroads were built. Mr. Davenport retired from active business in the early sixties. For 22 years his firm led in the car business of the country, having built between 1834 and 1856, $3,000,000 worth of cars, for more than 50 different roads in the eastern part of the United States, and also for roads in Cuba. In 1849 Mr. Davenport's property was lost by a fall in the value of stocks, which he had taken in payment of contracts, but his credit was good and he went ahead and retrieved his fortunes.

—Mr. Joseph Billingham, the new Division Master Mechanic of the Baltimore & Ohio at Parkersburg, W. Va., was born at Louth, Lincolnshire, Eng., in 1853. For five years, from 1865, he served an apprenticeship in the shops of the Great Northern Railway of England, and from 1870 to 1872 he was Master Mechanic at the Belfast shops of the Belfast & Northern Counties Railway of Ireland. He came to America in 1872 and became machinist on the Wisconsin Division of the Chicago & North Western. A year later he became fireman on the Pennsylvania, remaining as such until 1875. From then until 1882, he held the various positions of Machinist, Engineer and Traveling Engineer with the Michigan Central, and then for eight years to 1890 he was Engineer and Traveling Engineer on the Chicago, Milwaukee & St. Paul. From December, 1890, to April of the following year, he was Road Foreman of Engines on the Gulf, Colorado & Santa Fe, and then to November, 1891, he was Division Master Mechanic on that road, with office at Temple, Texas. From this latter date to June, 1894, Mr. Billingham was General Master Mechanic on the G., C. & S. F., and then from January, 1894, to November, 1897, he was Division Master Mechanic on the Baltimore & Ohio at Garrett, Ind. From November, 1897, to February, 1900, he was Master Mechanic at Pittsburg, Pa.; Feb. 1, 1900, to Feb. 1, 1903, Master Mechanic at Cumberland, Md., when he was transferred to Parkersburg.

—Mr. Charles Chancellor Wentworth, Principal Assistant Engineer of the Norfolk & Western, was born in Philadelphia, Pa., Feb. 21, 1856, and graduated from the University of Pennsylvania in 1876. After Mr. Wentworth had served as levelman on the Seaboard pipe line survey and as rodman, levelman and transitman on the Parksburg, St. Petersburg & Clarion under Mr. John Graham, Jr., Chief Engineer, Mr. Graham went to Virginia as Chief Engineer of the New River Railroad and Mr. Wentworth became his assistant. When the New River Railroad was taken over by the newly organized Norfolk & Western, Mr. Wentworth was retained in its service under Mr. W. W. Coe, Chief Engineer. In 1889 Mr. Wentworth left the Norfolk & Western to become Chief Engineer of the American Bridge & Iron Co., of Roanoke, Va., where, in addition to the duties of his office, he originated a system of standardization for highway bridge construction, which is still in use by the bridge company. In 1898 he returned to the service of the Norfolk & Western as bridge engineer. In 1901 he was awarded the Longstreet medal by the Franklin Institute for an analysis and design of hydraulic rams with a view to extending their use to pumping large quantities of water, and also did important original investigation in problems of ventilation for tunnels, etc., for the purpose of the installation at the Big Bend tunnel, on the Chesapeake & Ohio, described in a recent issue of the *Railroad Gazette*. Mr. Wentworth's present appointment dates from Feb. 1, 1903.

ELECTIONS AND APPOINTMENTS.

Canadian Pacific.—H. J. Cambie has been appointed Special Assistant Engineer, with headquarters at Vancouver, B. C., and duties as assigned. F. F. Busteed is appointed Division Engineer of the Pacific Division, succeeding Mr. Cambie.

Cape Breton Ry.—R. W. Leonard has resigned as Chief Engineer and General Manager, and is succeeded by Jay Downer. Headquarters, Port Hawkesbury, N. S.

Central & Western Association of Car Service Agents.—J. R. Kearney, Superintendent of Car Service of the Baltimore & Ohio, has been elected President of this Association, succeeding J. R. Cavanagh, of the Big Four.

Chicago & North Western.—Chas. A. Cairns, Assistant General Passenger and Ticket Agent, has had his title changed to General Passenger and Ticket Agent. Headquarters, Chicago. Effective March 1.

The Fremont, Elkhorn & Missouri Valley will hereafter be known as the Nebraska & Wyoming Division of the Chicago & North Western. Geo. F. Bidwell, heretofore General Manager of this road, will have the title of Manager. General Freight Agent John A. Kuhn has been appointed Assistant General Freight and Passenger Agent, with W. H. Jones as Division Passenger Agent. Mr. Bidwell's office will remain at Omaha. Mr. Kuhn and Mr. Jones were heretofore chief clerks in the Passenger and Freight Departments. F. A. Harmon, H. C. Manhanna and C. H. Reynolds, heretofore Division Superintendents, have become District Superintendents. No appointment is announced of former Passenger Agent I. R. Buchanan, of the Fremont, Elkhorn & Missouri Valley.

R. H. Johnson, hitherto Trainmaster at New Castle, Pa., on the Baltimore & Ohio, has been appointed Superintendent of Terminals at Chicago for the C. & N. W.

See also Elgin, Joliet & Eastern.

Chicago, Lake Shore & Eastern.—See Elgin, Joliet & Eastern.

Chicago, Peoria & St. Louis.—W. H. Gridley has been appointed General Manager succeeding Curtiss Millard, resigned to accept service elsewhere.

Chicago, Rock Island & Pacific.—J. F. Stevens, formerly Chief Engineer and General Manager of the Great Northern, has been appointed Chief Engineer of the Rock Island, succeeding Mr. Dauchy, recently resigned.

Geo. W. Taylor, General Foreman of the Illinois Central shops at Clinton, Ill., has been appointed Superintendent of Shops for the Rock Island at Cedar Rapids.

Choctaw, Oklahoma & Gulf.—N. C. Phillips, heretofore Acting Superintendent, has been appointed Superintendent of the Western Division, with headquarters at Oklahoma City.

Colorado & Southern.—Joseph Munday has been appointed Superintendent of Telegraph, Denver, Colo., succeeding F. E. Clary, resigned.

Denver & Rio Grande.—David Patterson has been appointed Master Mechanic of the First Division.

Elgin, Joliet & Eastern (Chicago & North Western).—Arthur Montzheimer, formerly Superintendent of Bridges and Buildings of the Chicago & North Western, has been appointed Chief Engineer of the E., J. & E., and the Chicago, Lake Shore & Eastern roads, with headquarters at Joliet, Ill. He succeeds W. B. Causey, resigned.

Erie.—W. B. Taylor has been appointed Division Engineer at Buffalo, succeeding M. D. Fairchild, recently resigned.

Grand Rapids, Grand Haven & Muskegon.—W. K. Morley, lately Superintendent of the Louisville Division of the Southern Ry., has been elected Vice-President and General Manager of the G. R., G. H. & M., with office at Grand Rapids, Mich.

Grand Trunk.—W. W. Ashald has been appointed Superintendent of Telegraph, with office at Montreal, P. Q. He will have charge of the telegraph and telephone service. Operators are to send to the Superintendent of Telegraph on the 7th, 14th, 21st and last day of each month their office copies of all train orders received during the preceding period.

Great Northern.—F. E. Ward, heretofore General Superintendent, has been elected General Manager, succeeding to the office recently resigned by Mr. Stevens. No announcement is made of who is to assume the duties of Chief Engineer.

John Dickson, Superintendent of the Delta shops, has not resigned, as erroneously reported in this paper Feb. 6, but Geo. Dickson, General Foreman of the shops at St. Paul, has resigned.

Hecla Belt Line.—Geo. C. McFarlane, Engineer, has been transferred, and J. V. McKean has succeeded him, with headquarters at Detroit.

Illinois Central.—See Chicago, Rock Island & Pacific.

Kansas City, Mexico & Orient.—J. A. Foley, heretofore Division Superintendent of the Missouri Pacific at Sedalia, Mo., has become General Superintendent of the K. C., M. & O., at Kansas City.

Lackawanna & Wyoming Valley.—Chester P. Wilson is appointed Superintendent, with office at Scranton, Pa.

Lehigh Valley.—J. A. Middleton, Second Vice-President, has announced that after March 9 all business for the Purchasing Department should be addressed to the Second Vice-President.

Michigan Central.—Wm. O'Keefe, Trainmaster at Chicago, has been appointed Assistant Superintendent of the Toledo Division, with headquarters at Detroit.

Minneapolis, St. Paul & Sault Ste. Marie.—W. L. Martin, who has been General Freight Agent, is appointed Traffic Manager, with headquarters at Minneapolis.

Missouri, Kansas & Texas.—See St. Louis & San Francisco.

Missouri Pacific.—It is announced that J. F. Simms, Division Superintendent at Concordia, Kan., will succeed J. A. Foley as Division Superintendent at Sedalia, Mo., resigned to go with the Kansas City, Mexico & Orient.

National of Tehuantepec.—W. B. Ryan has been appointed General Traffic Manager, with headquarters at Mexico City.

Orange & Northwestern.—H. L. Montandon has been appointed Chief Engineer, with office at Orange, Texas, succeeding J. W. Maxcy as Chief Engineer and Assistant to the President, with office at Houston.

Pere Marquette.—Newman Erb, heretofore Assistant to the President, has been elected Vice-President and has been authorized to discharge the duties of President in the absence of F. H. Prince, who is in Europe.

Pittsburgh, Cincinnati, Chicago & St. Louis.—M. Dunn, Master Mechanic at the Dennison shops, has been appointed Master Mechanic at Columbus, succeeding T. M. Butler, transferred to Indianapolis. P. F. Smith, Jr., now at Logansport, Ind., will be Master Mechanic at Dennison, succeeding Mr. Dunn.

Rio Grande Western.—E. H. Williams is appointed Assistant Superintendent of the First District, with headquarters at St. Lake City, Utah. George Geiger is appointed Assistant Superintendent of the Second District, with headquarters at Grand Junction, Colo.

St. Louis & San Francisco.—D. A. Bowersock, General Foreman of Bridges and Buildings, Missouri, Kansas & Texas, at Denison, has been appointed to a similar position with the St. Louis & San Francisco, with headquarters at Joplin, Mo.

Southern Pacific.—J. H. Austin has resigned as Superintendent of construction on work between Great Salt Lake and Ogden, and is succeeded by D. Ogden, heretofore Trainmaster on this section.

Southwestern Passenger Mileage Bureau.—C. M. Pratt has resigned as Joint Agent of the Southwestern Passenger Bureau; and, the Bureau having been abandoned, J. E. Hannegan has been appointed Acting Joint Agent, with office at St. Louis, in charge of mileage tickets and clergy certificates. It has also been arranged for Mr. Hannegan to handle as joint agent all matters pertaining to excursion rates, etc., the same as has heretofore been done through the Southwestern Passenger Bureau. The circular announcing this is signed by John Sebastian, Rock Island; C. Haile, Missouri, Kansas & Texas; H. C. Townsend, Missouri Pacific; Bryan Snyder, Frisco System; S. F. B. Morse, Southern Pacific, and E. P. Turner, Texas & Pacific.

Union Pacific.—F. W. Hibbetts, Mechanical Engineer at Omaha, Neb., has been appointed to the new office of Assistant Superintendent of Motive Power and Machinery.

Union Terminal Ry. (Sioux City, Iowa).—B. S. Josselyn has been appointed General Manager, succeeding W. L. Stevenson, heretofore General Manager and Master Mechanic, resigned.

Vera Cruz & Pacific.—G. A. Stranahan, Engineer Maintenance of Way, Mexican Central, has been appointed to a similar office on the V. C. & P., with headquarters at Cordoba, Mo.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Arkansas Northeastern.—A charter has been granted this company to build from a point near Piggott, Ark., Clay County, in a southeasterly direction to a point on the St. Francis River, nine miles. The directors are J. M. Meyers, H. W. Moore, F. G. Taylor, of Jonesboro, Ark., and others.

Atlanta & Marietta Electric.—This company has been organized in Georgia to build from Atlanta northwest to Marietta, 20 miles. P. D. McCarley, Atlanta, Ga.; J. L. Anderson, Marietta, and others are interested.

Baltimore & Ohio.—Contract for the building of a tunnel 2,000 ft. long, on the Cleveland, Lorain & Wheeling has been let. The tunnel is to be at Flushing, Ohio, which is 31 miles northwest of Bellaire. It is a part of extensive improvements which are planned by this company between Fairmount and Cleveland.

Berwyn Connecting.—Articles of incorporation have been filed by this company in Illinois, to build from Oak Park, just outside of Chicago, southwest to Lagrange, 10 miles. T. B. Cole, Geo. R. Jenkins, Wm. F. Smith and others of Chicago, are interested.

Binghamton & Southern.—This company has been incorporated in Pennsylvania to build from Binghamton, N. Y., southwest via Vestal and Rush, to Williamsport, Pa., 112 miles. Geo. E. Green, Binghamton; C. F. Wright, Susquehanna, Pa., and F. A. Sawyer, Towanda, Pa., are directors.

Blackwell & Northeastern.—Charter has been granted this company to build from Blackwell, Okla. T., northeast to Coffeyville, Kan., 90 miles, and thence in a northerly direction to Kansas City. The incorporators are E. L. Peckham and Geo. Corwin, Blanchard, Okla. T., and D. C. Smith, of Guthrie.

Boca & Loyalton.—Amended articles of incorporation were filed by this company on Feb. 7. It is proposed to build from Boca, Cal., in a northerly direction to Beckwith, and thence in a westerly direction to Quincy, 85 miles. This line, if built, will parallel at certain points the projected route of the Stockton & Beckwith Pass.

Boston & Seattle.—This company has been organized in Montana to build from Basin northwest through a rich mining region to Elliston, 20 miles. A smelter is to be built in connection with the road. This is the same project as was noted in our issue of Nov. 21, p. 901, under the heading of Basin-Elliston. A branch is proposed from Ontario north to Rimini, 15 miles.

Boston Mountain.—This company has been incorporated in Arkansas, to build from Buffalo in a southerly direction through Marion and Buffalo Counties to a connection with the St. Louis & North Arkansas in Searcy County, a distance of about 50 miles. E. C. Cook, Buffalo; L. J. Albert and W. B. Harris, Winnerva, Ark., are interested.

Brandon, Saskatchewan & Hudson's Bay.—Application is being made before the Dominion Parliament for the incorporation of a company to build from the international boundary of Manitoba between ranges 23 and 25 west, in a northerly direction to Brandon, thence to Pas Mission on the Saskatchewan River, and to Fort Churchill on Hudson's Bay, with branches northwest to the Souris River, and from Brandon northwest to Neepawa. Clement and Clement, Brandon, Man., are interested.

California Roads.—Surveys are reported for a narrow gage road from Campbells station, seven miles north of Sonora, Cal., in a northerly direction to Strawberry, in Calaveras County, 30 miles. R. I. Beardslee, Stockton, Cal., is interested.

Council City & Solomon River.—The Western Alaska Construction Co. of Chicago has filed maps and surveys for the building of its road in the Seward Peninsula, Alaska. It is proposed to connect Council City and the York and Nome regions with tidewater at Solomon City and Good Hope Bay.

Danville & Eastern.—This company has recently been incorporated in Illinois, to build and operate a line from the western part of Vermillion County to Danville. H. C. Martin, Attica, Ind.; W. C. Johnson, Geo. T. Buckingham and others, of Danville, Ill., are interested.

Denver, Northwestern & Pacific.—The Colorado-Utah Construction Co., which is building this line, has let contracts for 140,000 ties for the portion of the line between Denver and Kremmling. The contracts are reported let to Texas firms, and the Texas long leaf pine tie will probably be used.

Eel River, Eureka & Pacific.—This line, projected from Piperwood south via Laribee, Cal., to Southfork, 12 miles, is now being graded to Laribee, six miles, by the forces of the Pacific Lumber Company. (Official.)

Guelph & Georgian Bay.—Application is being made to the Dominion Parliament to incorporate a company to build from Guelph north to Owen Sound or Meaford, Ont., 75 miles. D. Guthrie, Guelph, Ont., is said to be interested.

Kokomo-Marion.—It is reported that a company has been incorporated in Indiana to build an electric line 25 miles long between these two points. O. V. Darby and T. C. McReynolds, of Kokomo, and H. D. Thomas, of Marion, Ind., are interested. The main office of the new line will be at Kokomo. Rights of way are now being secured.

Lake Erie & Detroit River.—Application to the Dominion Parliament is now being made, for an act authorizing the building of a branch from a point south of Walkerville, in a westerly direction to the Detroit River or Lake Erie near Amherstburg; also a branch from Walkerville to Sandwich. Incorporation is also asked for a company to build from Sarnia to St. Thomas, and from St. Thomas to the Niagara River.

Liberty-White.—Bids will be received by J. J. White, McComb City, Miss., until March 10, for the grading of this road from Liberty east to White, Miss., 25 miles. The new line will be built for 13 miles along the grade of an old narrow gage logging road, which runs out of Liberty. (Feb. 6, p. 108).

Maine & New Hampshire.—An act has been introduced in the Maine Legislature for the incorporation of this road. The act authorizes the building of a line connecting with the Maine Central at Standish, Me., and extending across Saco River southwest through Limington to a connection with the Boston & Maine, at Hollis, on the west side of the Saco River. L. C. Cornish, E. B. Hastings, A. C. Kennett and others, of Portland, Me., are interested.

Manitoba Roads.—Application is now being made by T. M. Daly, formerly Minister of the Interior of Canada, for an act to incorporate a company to build a number of lines through the Province, four of which are projected to the International boundary near Gretna, Crystal City, Morden and Emerson.

Memphis, Helena & Louisiana.—The contract for this line from Marianna, Ark., northeast to Bridge Junction, 51 miles, has been let to the Bracey-Howard Construction Co., Chicago, Ill. Grading is required to be finished by August 1, 1903.

Midland Pacific.—Work is reported begun on this line between Sunset in Kern County, Cal., and Port Harford on the coast near San Luis Obispo. The line will eventually be extended to Bakersfield. Negotiations have just been closed with Kelley, Endicott & Co., of Boston, for the sale of the entire issue of $5,000,000 of bonds. These will be issued at the rate of $25,000 for each mile. J. I. Wagy is now at work grading near Sunset. A. Feist, San Francisco, Cal., is an incorporator. (Feb. 20, p. 142).

Muskingum Valley Traction.—Articles of incorporation have been filed in Ohio. It is proposed to build down the Muskingum River through Muskingum County in a southerly direction to Marietta, Ohio. S. A. Wells, W. B. Cosgrove and J. C. England, Zanesville, Ohio, are interested.

St. Louis & North Western.—An officer writes that surveys are completed on this new line which is building from Mokane, Mo., on the Missouri, Kansas & Texas, to Brookfield, 120 miles, via Fulton, Columbia, Roanoke, Salisbury and Marceline. Contracts are to be let soon. J. H. Baker, Salisbury, Mo., is President. (Oct. 10, p. 786.)

St. Louis & San Francisco.—The contract for building the extension from Red Fork, Ind. T., southwest to Enid, Okla. T., 115 miles has been let to the McCabe & Stein Construction Co. Work is to begin at once.

St. Mary's, Suwanee & Gulf.—The route of this proposed line is from a point near Crandall, Fla., west through Charlton, Georgia, Baker and Suwanee Counties to Live Oak, 90 miles, with a probable extension through Lafayette, Taylor, Jefferson and Wakulla Counties to a point 20 miles south of Tallahassee. Frank Drew and R. M. Ellis, Jr., Live Oak, Fla., and Geo. L. Drew, of Jacksonville, Fla., are incorporators.

San Jose, Saratoga & Los Gatos (Electric).—Bids are being received at the office of F. S. Granger, San Jose, Cal., for the building of an electric line between the above named points in California, a distance of 22 miles. James W. Rea is President.

San Juan-Ponce (Porto Rico).—The Vandegrift Construction Company, Philadelphia, has obtained a franchise from the Porto Rican Commission to build an electric line 80 miles long, between San Juan and Ponce. The proposed route is from San Juan southwest through Caquas, Cayey, Coamo and Juan Diaz to Ponce. The road will be standard gage, equipped with 75-lb. T rails, and there will be one steel bridge 1,500 ft. long near San Juan. Water power will be used at two points in the interior of the island to generate electricity for industrial lighting, and railroad purposes. The concession allows three years for the completion of the road, which will cost approximately $3,000,000.

San Pedro, Los Angeles & Salt Lake.—The extension from Los Angeles, Cal., east to Riverside, 52 miles, has been completed. This is a part of the proposed line from Salt Lake, Utah, to San Pedro, Cal., approximately 1,000 miles. W. A. Clark, of Montana, is President. (Jan. 16, p. 56).

Southern Pacific.—This company is now receiving large quantities of 80-lb. steel rails from Germany for new track on its various divisions, including the Central Pacific. It is officially stated that 40,000 tons of these rails have been ordered from Germany, and that about 15,000 tons have already arrived at San Francisco.

The branch line of this company between Old Beach and Imperial, Cal., has been completed. A survey from Imperial to a point on the boundary line of Mexico is now being made.

Springfield Southwestern.—Charter has been granted to this company in Missouri to build from Eldon, Miller County, in a southerly direction to a connection with the White River Line, which is now being built from Batesville to Carthage. The proposed line will pass through Morgan, Miller, Camden, Stone and other counties, and will be about 160 miles long. The directors are C. G. Warner, Russell Harding, E. G. Merriam and others, all of whom are officials of the Missouri Pacific.

Toledo, Fostoria & Findlay (Electric).—It is reported that this company will build from Toledo south to Fostoria, Ohio, 32 miles. A bond issue of $1,000,000 has been authorized for this purpose. The road at present is 17 miles long. S. W. Croxton, Cleveland, Ohio, is President, and A. Miller, Fostoria, is Superintendent and Chief Engineer.

Union Pacific.—It is reported that the following improvements will shortly be made by this company on its various lines in Wyoming. Five miles of second track will be laid east of Cheyenne, and a long curve eliminated. In Echo Canyon 10 miles of the line will be improved, including ballasting of the track and reduction of grades. Near Buford, Wyo., 14 miles of second track will be laid.

Work is reported begun on the second track from Silver Creek southwest to Watson's ranch, Neb., 100 miles.

Watsonville Transportation.—Articles of incorporation were filed by this company in California on Feb. 13. It is proposed to build an electric line from Watsonville west to Monterey Bay, which can be connected with San Francisco by steamboats. F. A. Kilburn, R. W. Easton, W. J. Rodgers and others, of Watsonville, Cal., are directors.

Winterport, Frankfort & Prospect.—A bill has been introduced in the Maine Legislature to incorporate this company to build an electric line from Hampden, Me., south through Winterport and Frankfort, along the west bank of the Penobscot River to Prospect, 20 miles.

GENERAL RAILROAD NEWS.

Canadian Northern.—See Great Northern.

Canadian Pacific.—The purchase of 14 steamers from Elder, Dempster & Co., by the Canadian Pacific, has been concluded, the purchase price being reported as $7,500,000. Sir Thomas Shaughnessy, Vice-President and Manager of the Canadian Pacific, is quoted as saying that five of the 14 steamers will be devoted to passenger service, and that three more passenger boats of 10,000 tons each will probably be built during the coming year on the Clyde. The average speed of the vessels constituting the fleet is said to be about 15 knots, and the tonnage ranges between 5,000 and 9,000. Nine of the vessels are twin-screw steamers.

Chicago, Milwaukee & St. Paul.—This company has bought the Wisconsin Western, which runs between La Farge and Wauzeka, Wis., 52 miles. The price paid is not stated.

Chicago, Rock Island & Pacific.—The Texas State Legislature has passed the bill authorizing the Chicago, Rock Island & Pacific to buy and operate the Chicago, Rock Island & Texas, the Chicago, Rock Island & Mexico, and the Choctaw, Oklahoma & Texas Railroads.

Delaware & Hudson.—Gross earnings for the year ending Dec. 31, 1902, were $22,500,794, as against $29,497,455 in 1901, a decrease of $6,996,661. Operating expenses show a decrease of $5,013,815. Net earnings in 1902 were $5,619,902, a decrease of $1,982,846 over 1901, showing that the loss in coal traffic experienced by this road during 1902 was largely offset by reduced operating expenses and by increases in merchandise traffic.

Delaware, Lackawanna & Western.—Gross earnings for the year ending Dec. 31, 1902, were $21,398,764, a decrease of $2,108,369 from 1901. The total operating expenses for 1902 were $13,641,051, an increase of $28,872 over 1901. Net earnings were $7,757,712, a decrease of $2,137,742.

Erie.—The gross earnings of all the lines worked or controlled by this company for the seven months ending Jan. 31, were $25,748,872, as against $24,621,035 during the same time in 1901 and 1902, an increase of $1,127,837. Operating expenses for the same seven months were $17,705,361, an increase of $538,689; net earnings, $8,043,511; increase, $589,148.

Great Northern of Canada.—A controlling amount of the stock of this company has been acquired by Mackenzie & Mann in the interest of the Canadian Northern, and it is understood that the export and import traffic of the Canadian Northern will now pass over the lines of the Great Northern.

Konakau.—This company has been sold to President Wilson of Wilson, Lyonds & Co., 10 Front street, San Francisco. He will build the road as projected along the west coast of the Island of Hawaii for a distance of 150 miles, with a terminus at the volcano of Kilauea, where connection will be made with the Hilo R. R. (Jan. 30, p. 92.)

Missouri, Kansas & Texas.—Governor Lanham, of Texas, has signed the bill authorizing the purchase by the Missouri, Kansas & Texas, of the Granger, Georgetown, Austin & San Antonio and the Denver & Washita Valley.

New York & Jersey.—A joint resolution has been passed by both houses of Congress granting permission to this company to build and operate a tunnel under land owned by the United States in New York City, bounded by Greenwich, Christopher, Washington and Barrows streets. This company purchased two blocks in the above vicinity from the Trinity Church Corporation in 1901.

New York Central & Hudson River.—According to a recent decision of the Court of Appeals, the New York & Harlem and the New York Central & Hudson River companies are relieved of responsibility for damages to abuttors on Park avenue by the elevation of the tracks south of the Harlem River.

Pennsylvania.—At the annual meeting of this company on March 10, the stockholders will undoubtedly vote to acquire the franchises and rights of the following six companies: The Western Pennsylvania, the South Fork, the West Chester, Downington & Lancaster, the River Front and the Turtle Creek Valley. All are now operated as parts of the Pennsylvania system.

Pere Marquette.—This company, jointly with the Bessemer & Lake Erie, has acquired the United States & Ontario Steam Navigation properties, which include docks at Conneaut, Ohio, and Port Dover, Ontario, on Lake Erie. It is reported that several vessels will be added to the present fleet owned by the company.

St. Louis, Iron Mountain & Southern.—The directors of this company have authorized a mortgage for $50,000,000. The bonds are to be 30-year 4 per cent. first mortgage gold bonds, and are to be a lien on proposed new lines to be known as the River & Gulf Division of the St. Louis, Iron Mountain & Southern. Ten million dollars worth of bonds have been taken by Vermilye & Co., of New York, and $10,000,000 more will be issued toward the end of the year. The present issue will pay for the line from East St. Louis to Thebes, Ill., with a branch to coal fields a total of 145 miles, and most of the proceeds from the remainder of the bonds will be used in building from West Memphis along the west bank of the Mississippi, via Arkansas City to Clayton, La., 278 miles, where a connection will be made with the Texas & Pacific; also for a branch from Batesville, Ark., to Carthage, Mo., 278 miles, making a total of about 700 miles. These new railroads will complete a line from St. Louis to New Orleans, and from Kansas City to Memphis and New Orleans. The grades will be more favorable and the distances less than by any existing line between these points. Bonds under this mortgage will also be used to acquire terminals in St. Louis and East St. Louis; to provide a transfer across the Mississippi south of St. Louis, and for the acquisition of the bonds of the Memphis Union Belt Ry.

Wisconsin Western.—See Chicago, Milwaukee & St. Paul, above.